

Tektronix®

8500

MODULAR MDL SERIES

68000

EMULATOR PROCESSOR
PROTOTYPE CONTROL PROBE

SERVICE

INSTRUCTION MANUAL



WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

PRELIMINARY

**PLEASE CHECK FOR CHANGE INFORMATION
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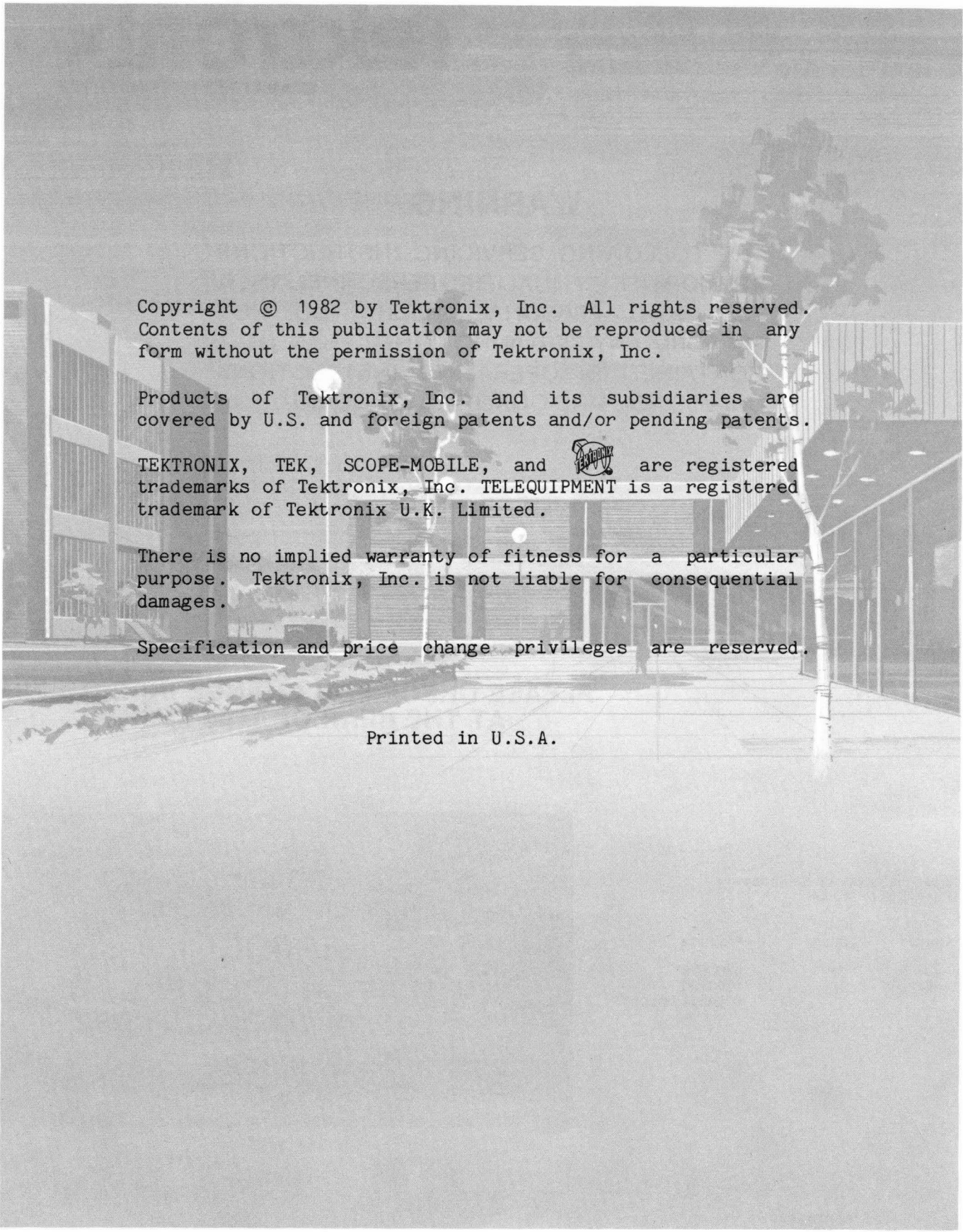
This manual supports the following
TEKTRONIX products:

8550 Option	8540 Option	Products
2P	2P	8300E26
3U	3U	8300P26
		8300P26 option 01

8500
MODULAR MDL SERIES
68000
EMULATOR PROCESSOR
PROTOTYPE CONTROL PROBE
SERVICE

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97077

Serial Number _____



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PREFACE

ABOUT THIS MANUAL

This manual contains servicing information for the 68000 Emulator Processor module and its associated Prototype Control Probe. The manual applies to use of this equipment in the TEKTRONIX 8550 Microcomputer Development Lab or 8540 Integration Unit.

Throughout this manual, the term "microcomputer development system" (or simply "development system") is used to refer to the TEKTRONIX 8550 Microcomputer Development Lab or 8540 Integration Unit.

The TEKTRONIX 68000 Emulator Processor module utilizes a Motorola MC68000L microprocessor to perform the emulation function. All references in this manual to the 68000 microprocessor pertain to the Motorola MC68000L microprocessor.

MANUAL ORGANIZATION

This manual is divided into 14 sections:

Section 1 contains general information about the Emulator Processor module and the Prototype Control Probe.

Section 2 contains information about electrical and environmental characteristics.

Section 3 discusses configuration jumpers and their functions.

Section 4 describes in general the operation of the Emulator Processor module and Prototype Control Probe.

Section 5 contains functional check procedures for the development system.

Section 6 contains power supply adjustment procedures.

Section 7 contains Emulator Processor module and Prototype Control Probe performance check procedures.

Section 8 describes general maintenance procedures.

Section 9 provides detailed installation procedures for the Emulator Processor module and the Prototype Control Probe.

Sections 10 thru 13 contain technical reference material, electrical parts list, schematic diagrams, and mechanical parts list with accessories information, respectively.

GENERAL INFORMATION

INTENDED USE

This manual is designed to be used by trained service technicians; it is not designed for use as a training guide. The intent is to provide a sufficiently detailed theory of operation and accompanying reference material to enable a technician to locate a problem to a particular component on a circuit board.

REVISION HISTORY

As this manual is revised and reprinted, revision history information is included on the text and diagram pages. Original manual pages are identified with an '@' symbol at the bottom inside corner of the page. When existing pages are revised, the '@' symbol is replaced with a revision date (REV OCT 1981). New pages added to a section, whether they contain old, new, or revised information, will be identified with the '@' symbol and a date (@ OCT 1981).

CHANGE INFORMATION

Change notices are issued by Tektronix, Inc., to document changes to the manual after it has been published. Change information is located at the back of this manual, following the yellow tab marked "CHANGE INFORMATION & TEST EQUIPMENT". When you receive the manual, you should enter any change information into the body of the manual, according to the instructions on the change notice.

HEXADECIMAL NOTATION

All addresses are in hexadecimal notation, unless otherwise noted. Where necessary for clarity, hexadecimal numbers are defined by an H following the number (i.e., 43ACH). Other hexadecimal identifiers, such as the prefix or suffix "hex" or subscripts denoting base 16, are not used.

SIGNAL LINE CONVENTIONS

In this manual, signal line names followed by the symbol (L) are active in the low state. Lines that are active in the high state may have no symbol following their names, or an (H) following the name if an ambiguity might exist. For example:

PPDOUT(L)
CS16
IO(H)/M(L)

DOCUMENTATION OVERVIEW

Support documentation for TEKTRONIX development systems consists of service manuals, installation manuals, and user's manuals.

Service Manuals

Service manuals provide the information necessary to perform system testing, to isolate hardware problems, and to repair system components. Service manuals are identified by their blue covers and may be purchased from Tektronix as optional accessories.

The following manuals provide service information for the various 68000 Emulator Processor host systems:

- 8301 Microprocessor Development Unit Service Manual
- 8540 Integration Unit Service Manual

Also available are service manuals for Emulator Processor modules, peripheral equipment, and optional features such as the PROM Programmer and the Trigger Trace Analyzer.

Installation Manuals

Installation manuals or guides tell how to unpack the equipment, and how to install it and verify its proper operation. Installation manuals may be separate manuals with blue covers, or may be provided as supplements to existing publications. Installation manuals are provided with the equipment as standard accessories.

The following installation manuals are available for the 68000 Emulator Processor and its host systems:

- 8500 MDL Series 68000 Emulator Processor and Prototype Control Probe Installation Service Manual
- 8550 Microcomputer Development Lab Installation Guide
- 8540 Integration Unit Installation Guide

The 68000 Emulator Processor and Prototype Control Probe Installation Service Manual is provided with the 68000 Prototype Control Probe as a standard accessory.

User's Manuals

User's manuals describe procedures required to operate the development system and its peripheral devices. User's manuals are identified by their grey covers and are provided as a standard accessory in the system package.

For an overview of your development system and its capabilities, the following manuals may be of interest:

- 8550 Microcomputer Development Lab System Users Manual (with the 68000 Emulator Processor Specifics supplement)
- 8540 Integration Unit System Users Manual (with the 68000 Emulator Processor Specifics Supplement)

To derive the greatest benefit from this manual, you should be familiar with your TEKTRONIX development system, as described in the appropriate manuals listed here. You should also be familiar with the 68000 microprocessor, described in The Complete Motorola Microprocessor Data Library, published by Motorola, Inc.

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OPERATORS SAFETY SUMMARY

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

TERMS

In This Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

As Marked on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

SYMBOLS

As Marked on Equipment

 DANGER high voltage.

 Protective ground (earth) terminal.

 ATTENTION - Refer to manual.

SAFETY PRECAUTIONS

Grounding the Product

The product is grounded through the grounding conductors in the interconnecting cables. To avoid electrical shock, plug the supporting system's power cord into a properly wired receptacle. A protective ground connection by way of the grounding conductor in the system power cord is essential for safe operation.

Use the Proper Fuse

To avoid fire hazard, use only the fuse specified in the parts list for your product. Be sure the fuse is identical in type, voltage rating, and current rating.

Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this product in an atmosphere of explosive gases.

Do Not Remove Covers or Panels

To avoid personal injury, do not remove covers or panels from this product. Do not operate the product without the covers and panels properly installed.

SERVICING SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

(Refer also to the preceding Operators Safety Summary)

DO NOT SERVICE ALONE

Do not perform internal service or adjustment on this product unless another person capable of rendering first aid and resuscitation is present.

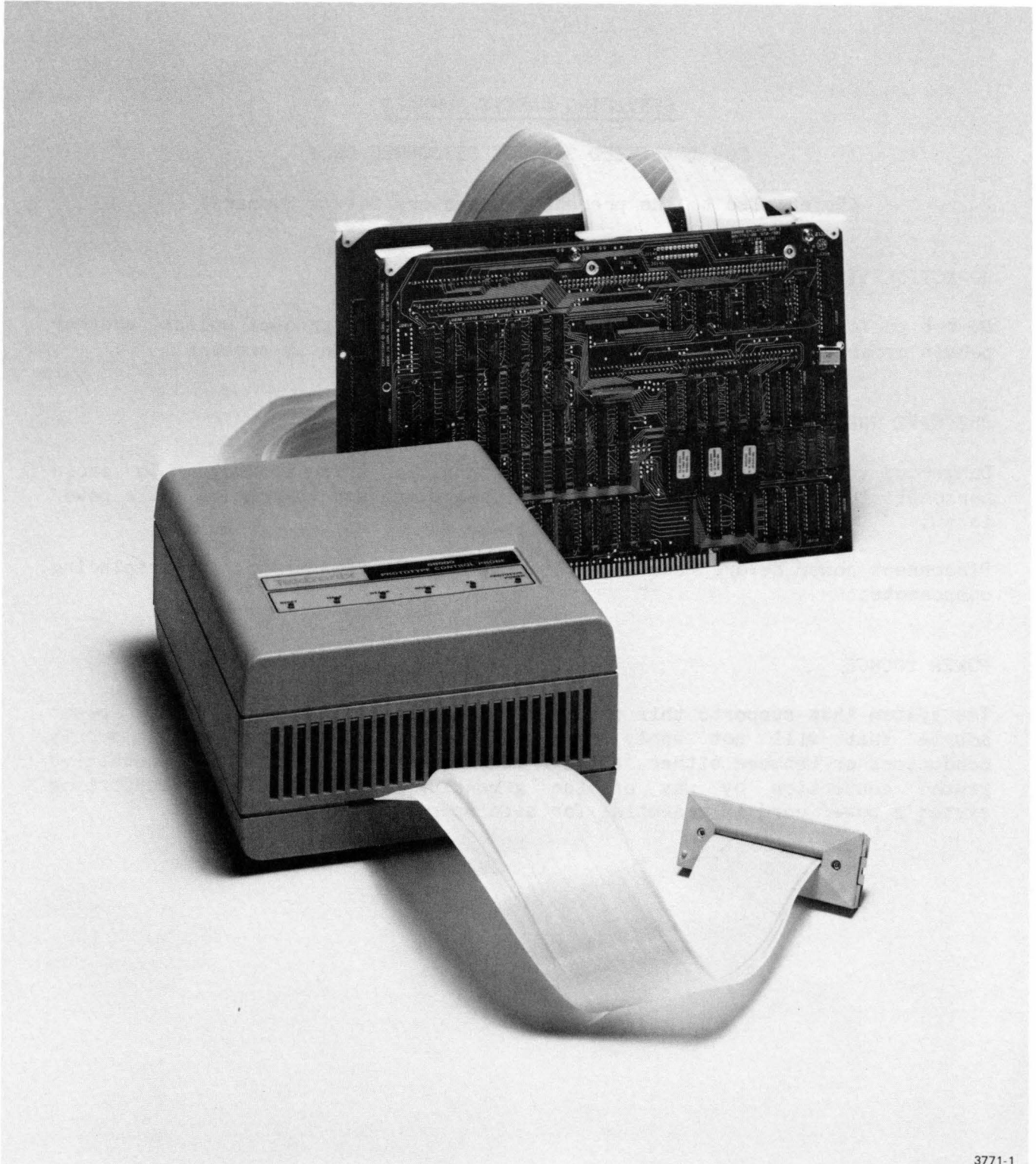
USE CARE WHEN SERVICING WITH POWER ON

Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed connections and components while power is on.

Disconnect power before removing protective panels, soldering, or replacing components.

POWER SOURCE

The system that supports this product is intended to operate from a power source that will not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the supporting system's power cord is essential for safe operation of this product.



3771-1

68000 Emulator Processor and Prototype Control Probe

Section 1

GENERAL INFORMATION

INTRODUCTION

The 68000 Emulator Processor is a microprocessor design aid that emulates a 68000 microprocessor. The 68000 Emulator Processor is operated in conjunction with the 68000 Prototype Control Probe and a TEKTRONIX microcomputer development system. In this arrangement the 68000 Emulator Processor and Prototype Control Probe effectively replace the 68000 microprocessor in your prototype circuit.

MODES OF OPERATION

The 68000 Emulator Processor module, with its Prototype Control Probe, may be operated in any one of three emulation modes. The mode is determined and set by the user. The emulator is controlled by the System Controller module in the microcomputer development system. The three emulation modes are described in the following paragraphs:

MODE 0 "System" mode. Mode 0 is used to develop software for a prototype 68000 microprocessor-based circuit. Mode 0 operation uses the development system's program memory, I/O facilities, and clock to execute a software program. In Emulation Mode 0, the development system acts as an independent 68000-based microcomputer. Prototype circuitry is not involved. Figure 1-1(a) illustrates Mode 0 operation.

MODE 1 "Partial emulation" mode. Mode 1 is used to develop the hardware functions of the prototype circuit. The Prototype Control Probe is used as the interface between the prototype circuit and the Emulator Processor module. Clock and control signals for Emulation Mode 1 are provided by the prototype circuit.

Another function available in Emulation Mode 1 is memory mapping. Execution memory may be mapped (in 4 K blocks) into program memory or to the user prototype. Figure 1-1(b) illustrates Mode 1 operation.

MODE 2 "Full emulation" mode. Mode 2 is used for the final development stages of hardware functions in the prototype circuit. The only difference between Mode 1 and Mode 2 operation is that in Mode 2, prototype memory is the single source of operation code. Program memory cannot be accessed. Figure 1-1(c) illustrates Mode 2 operation.

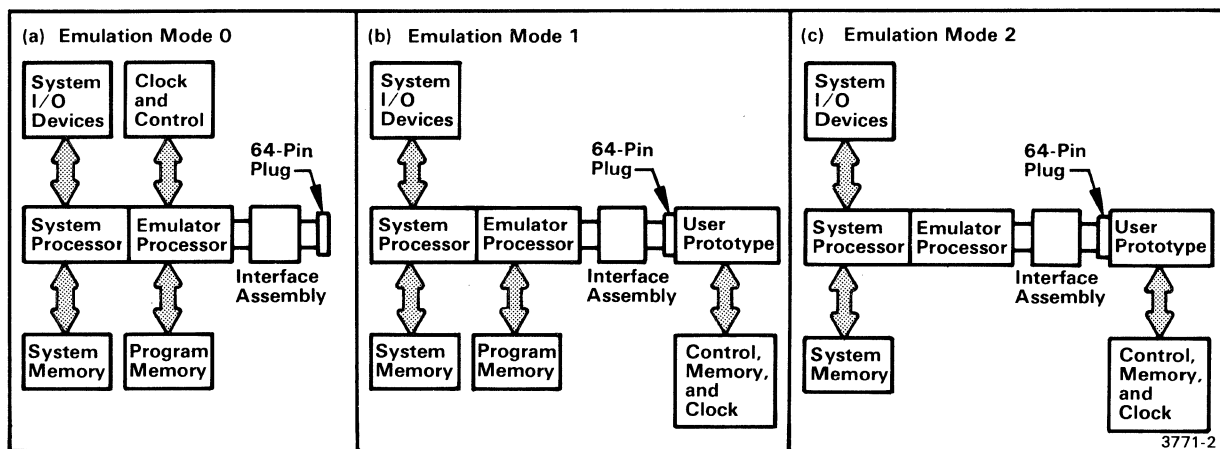


Fig. 1-1. Emulation Modes 0, 1, and 2.

EMULATOR PROCESSOR MODULE

The 68000 Emulator Processor module is illustrated in Fig. 1-2. This module consists of:

- Two emulator circuit boards that plug into the Main Interconnect board in the development system mainframe. Throughout this manual, these circuit boards are referred to as EMU 1 and EMU 2.
- Two short ribbon cables that interconnect EMU 1 and EMU 2.

The Emulator Processor serves two purposes in the development system. First, it has the ability to run a program written specifically for a 68000 microprocessor. With the help of other modules in the development system, the Emulator Processor can check the program for run-time errors or program logic errors. Second, when the Prototype Control Probe's 64-pin plug is used, a prototype circuit can be debugged and stepped through the final stages to design completion.

The 68000 Emulator Processor emulates the operation of a target 68000 microprocessor device that will be used in the final version of a prototype system. The Emulator Processor responds to software in the same way as the target microprocessor, and also allows software debugging.

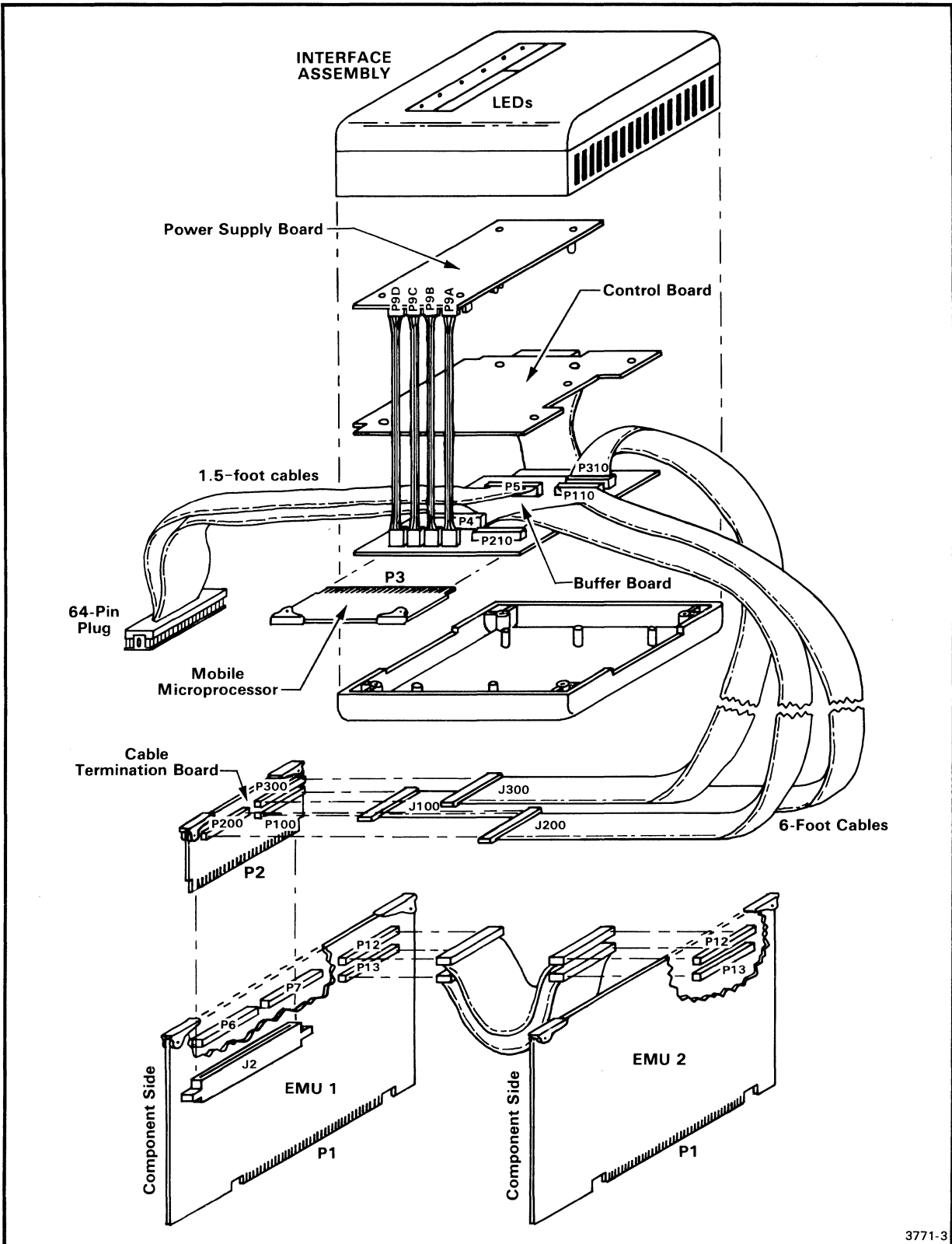


Fig. 1-2. 68000 Emulator Processor and Prototype Control Probe.

PROTOTYPE CONTROL PROBE

As illustrated in Fig. 1-2, the 68000 Prototype Control Probe consists of:

- The Cable Termination board that plugs into EMU 1.
- The Interface Assembly, containing the Buffer, Control, Power Supply, and Mobile Microprocessor boards.
- Three 6-foot ribbon cables that attach the Interface Assembly to the Cable Termination board.
- A 64-pin plug with two 1.5-foot ribbon cables that connect the Interface Assembly to the prototype circuit's 68000 microprocessor socket.

The Prototype Control Probe also includes five strain relief cable clamps to replace the original system cable clamps.

The Prototype Control Probe Interface Assembly contains the emulating microprocessor device, and thus is required for operation in all three emulation modes. In Mode 0 operation, the 64-pin plug may be connected to the prototype circuit, but will not use or drive any signals to or from the prototype. However, in Modes 1 and 2, the Prototype Control Probe acts as the interface between the Emulator Processor module and the prototype circuit. Therefore, in Modes 1 and 2, the 64-pin plug must be connected to a prototype circuit.

PROTOTYPE CONTROL PROBE LEDs

Six indicator LEDs are visible on the Prototype Control Probe's Interface Assembly. When the Emulator Processor is operating in Emulation Mode 1 or 2, these LEDs indicate the following conditions:

- Bus Grant: the Emulator Processor is giving up the bus to the development system.
- Bus Grant Acknowledge: the development system has acknowledged that the Emulator Processor has given up the bus.
- DTACK Timeout: the 68000 microprocessor has not received a DTACK (Data Transfer Acknowledge) within 1 ms of having requested one.
- User Vcc: the prototype power supply is functioning.
- Halt: the Emulator Processor's Halt line has been driven low.
- Reset: the Emulator Processor's Reset line has been driven low.

Section 2

SPECIFICATIONS

INTRODUCTION

The electrical and environmental characteristics listed here are general. For detailed environmental test procedures, including failure criteria, contact your local Tektronix Field Office or representative.

ELECTRICAL CHARACTERISTICS

Five supply voltages are used by the 68000 Emulator Processor module and its Prototype Control Probe. Three of these, +5.2 Vdc, +12 Vdc, and -12 Vdc, are generated by the development system and are taken directly from its Main Interconnect board. The remaining two supply voltages, +4.92 Vdc and +5 Vdc, are generated on the Power Supply board located in the Interface Assembly. The Emulator Processor module and its Prototype Control Probe use the supply voltages as follows:

- Emulator Processor Module

- +5.2 Vdc Primary supply voltage.

- Prototype Control Probe

- +5.2 Vdc Used by the Buffer, Control, and Mobile Microprocessor boards.

- 12 Vdc Used to power the fan in the Interface Assembly when the Emulator Processor is active.

- +12 Vdc Used by the Power Supply board to generate the +4.92 Vdc and +5 Vdc supply voltages when the Emulator Processor is active.

- +4.92 Vdc Supplies power for the Buffer and Control boards. This is a regulated supply and is active only when the Emulator Processor is selected (active).

- +5 Vdc Used only by the 64-pin plug when the Emulator Processor is selected (active).

Specifications - 68000 E.P. Service

Each of the three supply voltages generated by the development system is protected at the Cable Termination board with a 3AG, 250 Volt, 2 Ampere fuse.

The supply voltages generated on the Power Supply board (located in the Interface Assembly) are not fused.

Table 2-1
Electrical Characteristics

Characteristics	Performance Requirements	Supplemental Information
Supply Voltages	+5.2 Vdc +1%/-2% +12 Vdc ±5% -12 Vdc ±5% +4.92 Vdc ±20 mVdc +5 Vdc ±5%	Adjustable Adjustable
Current		Emulator not selected 6.8 A (max) @ +5.2 Vdc 150 mA (max) @ +12 Vdc Emulator selected 6.8 A (max) @ +5.2 Vdc 1.65 A (max) @ +12 Vdc 300 mA (max) @ -12 Vdc 3.4 A (max) @ +4.92 Vdc 15.3 mA (max) @ +5 Vdc

ENVIRONMENTAL CHARACTERISTICS

Table 2-2
Environmental Characteristics

Characteristics	Description
Air Temperature	
Operating	0°C to +50°C (+32°F to +122°F)
Storage	-55°C to +75°C (-67°F to +167°F)
Humidity	90% relative non-condensing, maximum
Altitude	
Operating	4 500 m (15,000 ft) maximum
Storage	15 000 m (50,000 ft) maximum

Section 3JUMPERSINTRODUCTION

The 68000 Emulator Processor Module and Prototype Control Probe have user-selectable configuration jumpers. This section describes the functional characteristics for the individual jumpers. Section 8 of this manual tells how to disassemble (and reassemble) the Prototype Control Probe. Table 3-1 lists the jumpers in the order they are discussed in this section. Only user-selectable jumpers are discussed here. All other jumpers are for factory use only and are not user-selectable.

Table 3-1
Jumper Locations

Board	Fig. No.	Jumpers
EMU 2	3-1	J2144
Buffer board	3-2	P1 P2 and P3 P6 P7 P8
Control board	3-3	J4011 J6021
Mobile Microprocessor board	3-4	J1045 and J2045

CONFIGURATION JUMPERS

The following pages describe each of the jumpers used to select specific operations of the 68000 Emulator Processor. All jumpers are in their 'normal' position (1--2) when shipped from the factory. These jumpers affect the operation of all three emulation modes unless otherwise indicated within the text. Some of the jumper configurations available may cause the system to hang (not respond) and are noted accordingly.

EMU 2

EMU 2 of the 68000 Emulator Processor module contains one configuration jumper: J2144. Figure 3-1 shows the location of J2144 on EMU 2.

NOTE

EMU 2 must be removed from your microcomputer development system, to allow access to J2144. Section 9 of this manual contains the procedure to remove EMU 2 from your development system.

J2144 controls the break cycle of the Emulator Processor after the emulator has executed a stop instruction.

- | | |
|---------------|--|
| Normal (1--2) | When a stop instruction is executed, the Emulator Processor will break and return control to the operating system <u>only</u> while the emulator is operating in Emulation Mode 0. |
| Option (2--3) | When a stop instruction is executed, the Emulator Processor will break and return control to the operating system. |

NOTE

When J2144 is in its normal (1--2) configuration and the Emulator Processor is being operated in Emulation Mode 1 or 2, the system will appear to hang (not respond). To return control to the operating system, you must request that the Emulator Processor break or issue a prototype interrupt. For information on how to request the Emulator Processor to break, refer to your System Users' Manual and its 68000 Emulator Specifics supplement.

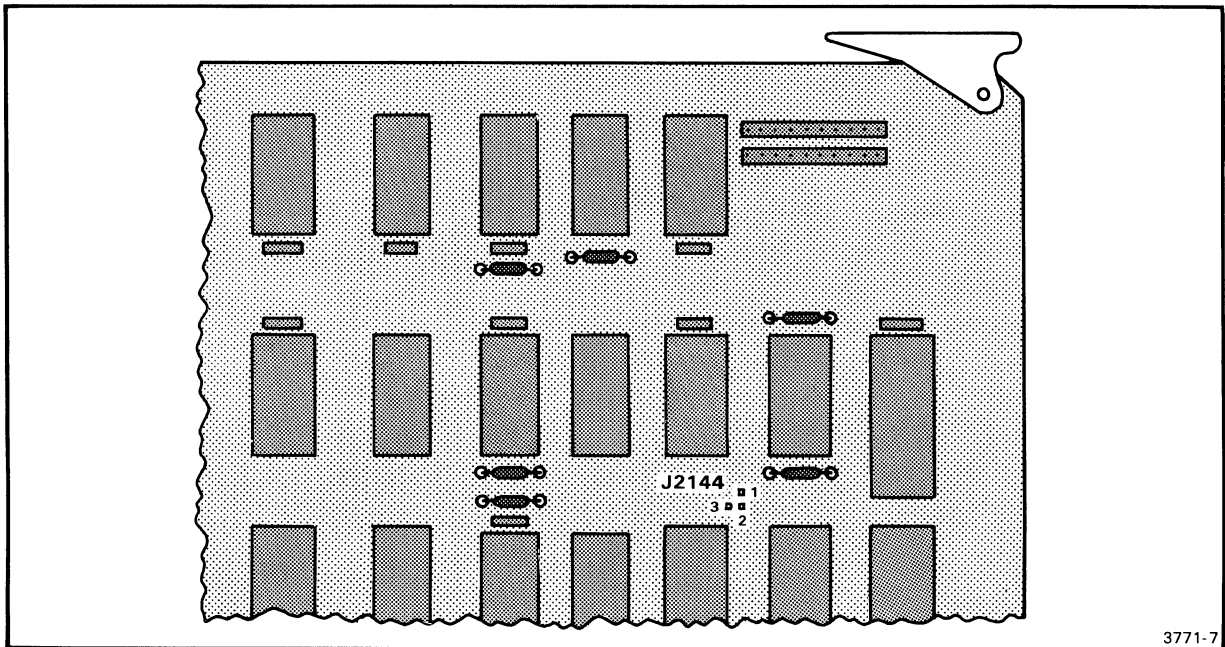


Fig. 3-1. EMU 2 jumper location.

BUFFER BOARD

The Buffer board contains six configuration jumpers: P1, P2, P3, P6, P7, and P8. Figure 3-2 shows the location of these jumpers on the Buffer board. To gain access to these jumpers, perform steps 1--7 of the Prototype Control Probe assembly/disassembly procedure located in section 8 of this manual.

P1 inserts or removes a delay between the prototype circuit's Data Transfer Acknowledge (DTACK) and the 68000 microprocessor while the emulator is operating in Emulation Mode 1.

NOTE

The configuration of jumper P1 depends on the configuration of Mobile Microprocessor board jumpers J1045 and J2045. See the discussion of the Mobile Microprocessor board jumpers, later in this section for more information.

- | | |
|---------------|---|
| Normal (1--2) | The prototype's DTACK is delayed at the rate determined by J1045 and J2045. This prevents overdriving the Program Memory's access time. |
| Option (2--3) | This configuration bypasses J1045 and J2045, allowing the prototype to return DTACK without delay. |

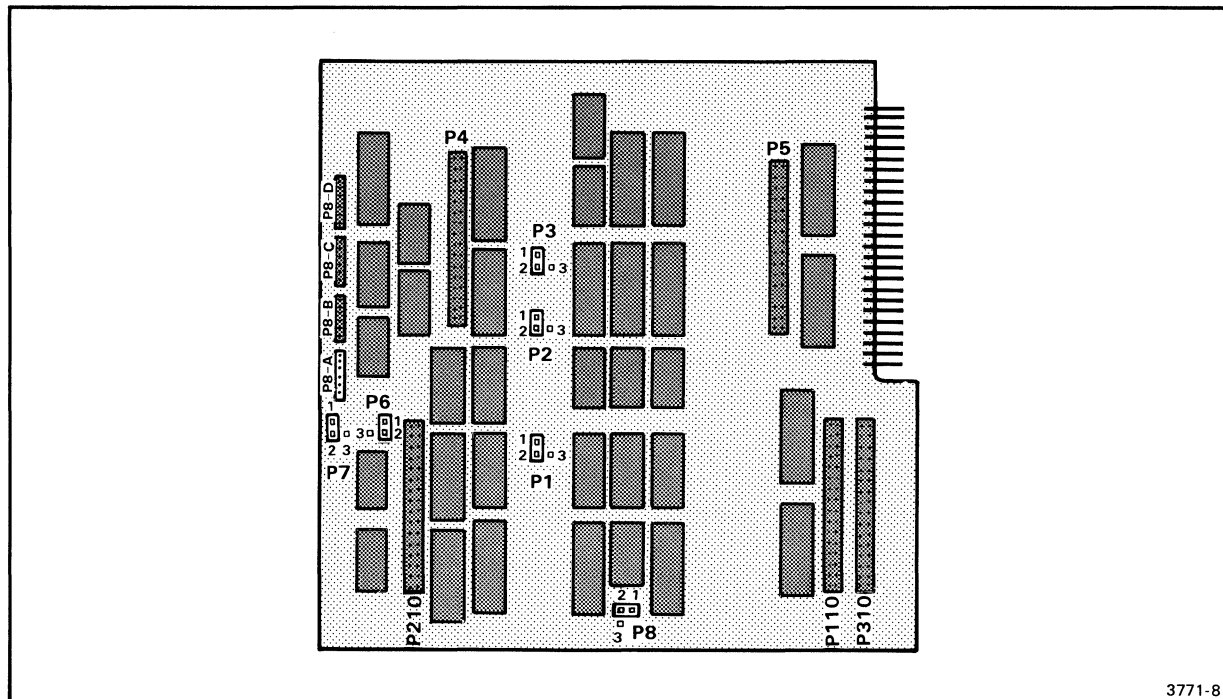


Fig. 3-2. Buffer board jumper locations.

NOTE

When P1 is in its optional (2--3) configuration, data may be invalid or lost if the Program Memory is accessed beyond its limitations. However, no component damage will result.

P2 and P3 control prototype bus arbitration during an Emulator Processor Dump and Restore routine.

Normal (both jumpers 1--2)

The prototype's Bus Request and Bus Grant Acknowledge signals to the 68000 microprocessor will be disabled whenever the Emulator Processor has returned control to the operating system.

Option (both jumpers 2--3)

The prototype's Bus Request and Bus Grant Acknowledge signals will be allowed to request and hold the 68000 microprocessor bus. This is valid even while the Emulator Processor has entered Dump and Restore, and returned control to the operating system.

NOTE

In the optional (2 to 3) configuration for P2 and P3, the system may hang (not respond). To return to normal operation, you must release the bus. Refer to your System Users Manual and its 68000 Emulator Specifics supplement for information on how to release the bus.

P6 determines when the 68000 microprocessor address strobe is driven to the prototype circuit.

Normal (1--2) The 68000 microprocessor address strobe is driven in all cycles except during an Emulator Processor Dump and Restore, or during an interrupt acknowledge of a Non-Maskable Interrupt (NMI) issued by the Emulator Processor.

Option (2--3) The 68000 microprocessor address strobe is driven in all cycles except during an interrupt acknowledge of an NMI issued by the Emulator Processor.

P7 controls how the Emulator Processor will react to a DTACK timeout (no prototype DTACK within 1 ms). This jumper is used when any of the following conditions exist:

- P8 is in its 'normal' position and no prototype DTACK is generated when memory is mapped to the prototype.
- P8 is in its 'optional' position and no DTACK is generated by the prototype circuitry.
- The development system is operating in Emulation Mode 2 and no prototype DTACK is generated.

Normal (1--2) The system will hang (not respond) until a DTACK is received from the prototype or a break condition occurs.

Option (2--3) The system will hang until a DTACK is received from the prototype, at which time the system will continue normal operation. A break condition will not clear the system.

P8 allows or prevents the internal generation of a Data Transfer ACKnowledge (DTACK) signal by the 68000 Emulator Processor while operating in Emulation Mode 1.

- Normal (1--2) Uses the prototype's DTACK until the map decision is made. If memory is mapped to the development system's Program Memory, then an internal DTACK is generated. If memory is mapped to the prototype, then DTACK must be generated by the prototype circuitry.
- Option (2--3) No internal generation of a DTACK signal is allowed, regardless of mapping. All DTACK signals must originate from the prototype circuitry.

NOTE

When P8 requires a prototype DTACK, the prototype circuit must generate a DTACK within 1 ms. If a prototype DTACK is required by P8 and no DTACK is generated by the prototype within 1 ms, then a DTACK timeout occurs. For more information regarding when a DTACK timeout may occur, see the discussion of jumper P7, earlier in this section.

CONTROL BOARD

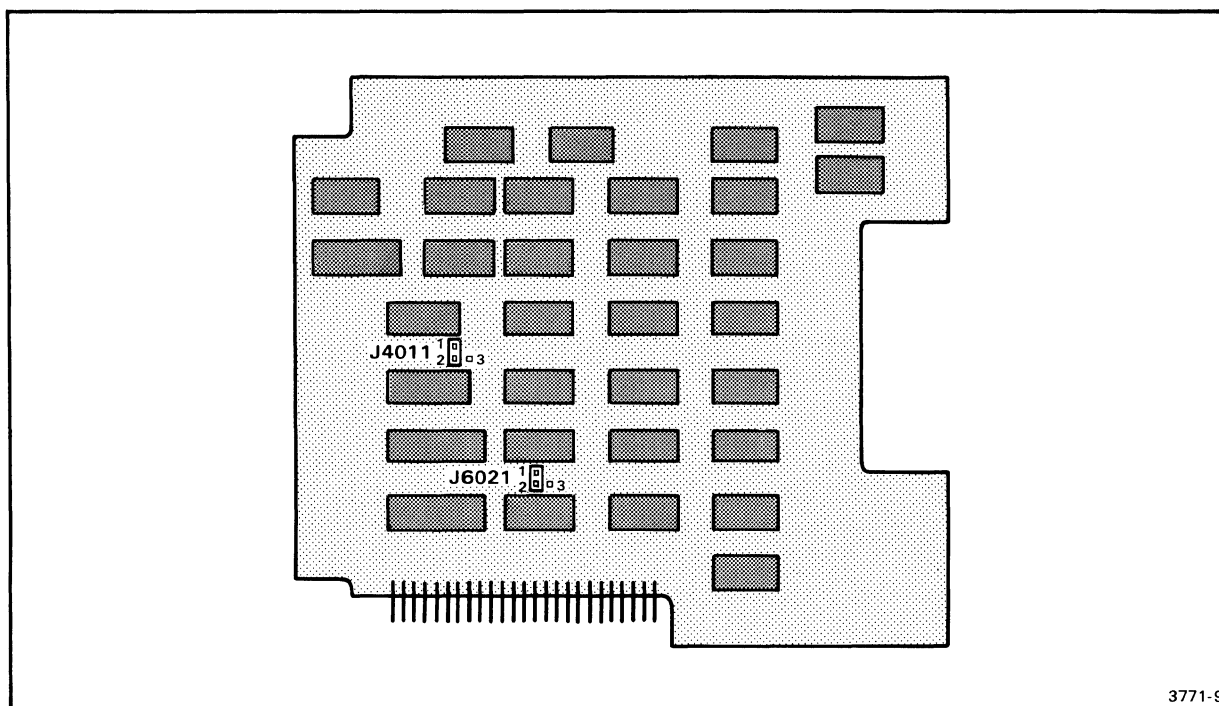
Two configuration jumpers are located on the Interface Control board: J4011 and J6021. Figure 3-3 shows the location of these jumpers on the Control board. To gain access to these jumpers, perform steps 1--7 of the Prototype Control Probe assembly/disassembly procedure located in section 8 of this manual.

J4011 controls whether Non-Maskable Interrupts (NMIs) are saved during Dump and Restore (D/R) routines.

- Normal (1--2) NMIs are saved during D/R routines (such as when the development system has control and the emulator is not running).
- Option (2--3) NMIs are never saved.

NOTE

Saved NMIs are issued to the 68000 microprocessor when the development system relinquishes control, and the Emulator Processor begins program execution.



3771-9

Fig. 3-3. Control board jumper locations.

J6021 controls whether prototype circuit interrupts (interrupt levels other than level 7) are saved during Dump and Restore (D/R) routines.

Normal (1--2) Prototype circuit interrupts (if held until acknowledged), are saved during D/R routines (such as when the development system has control and the emulator is not running).

Option (2--3) Prototype circuit interrupts are never saved.

NOTE

Saved interrupts are issued to the 68000 microprocessor when the development system relinquishes control, and the Emulator Processor begins program execution.

MOBILE MICROPROCESSOR BOARD

Two configuration jumpers are located on the Mobile Microprocessor board: J1045 and J2045. Figure 3-4 shows the location of these jumpers on the Mobile Microprocessor board. To gain access to these jumpers, perform steps 1--9 of the Prototype Control Probe assembly/disassembly procedure located in section 8 of this manual.

J1045 and J2045. In their 'option' positions, these jumpers delay assertion of Data Transfer ACKnowledge (DTACK) signals to the Emulator Processor. The delay is inserted to prevent the Program Memory from being accessed faster than its limitations will allow. Two different DTACK signals may be issued to the Emulator Processor: the 68000 microprocessor's DTACK and the prototype's DTACK. With J1045 and J2045 in their 'option' positions:

- Assertion of all 68000 microprocessor DTACK signals is delayed to the Emulator Processor.
- Assertion of the prototype's DTACK signals are delayed to the Emulator Processor only when operating in Emulation Mode 1 and jumper P1 is in its 'normal' position. (See the discussion of Interface Buffer board jumper P1, earlier in this section.)

The jumper positioning, as shown in Table 3-2, is based on which Program Memory configuration is installed in your development system.

NOTE

Use of J1045 and J2045 in their 'normal' configuration (see Table 3-2) may cause invalid data or loss of data if Program Memory is accessed beyond its limitations. However, no component damage will result.

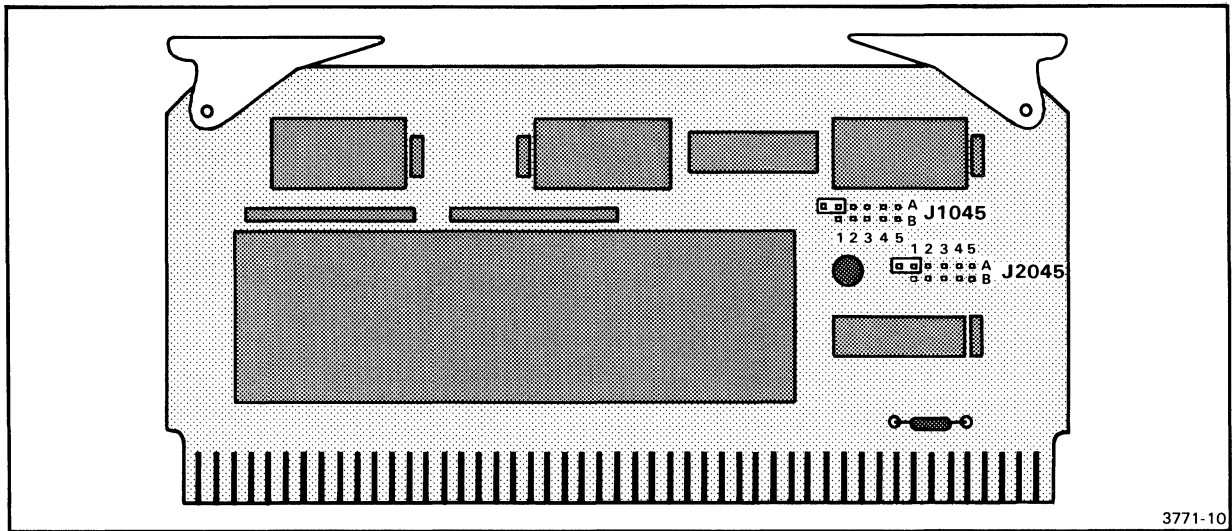


Fig. 3-4. Mobile Microprocessor board jumper locations.

Table 3-2
J1045 and J2045 Configurations (a)

Memory Configuration	Jumper Configuration(b)		Characteristic
	J1045	J2045	
32K Program Memory board	A1 to A	A1 to A	Normal (no delay)
64K or 128K Static Program Memory board	A1 to A	A1 to A	Normal (no delay)
64K or 128K Static Program Memory board and Memory Allocation Control	A1 to A	A1 to A	Normal (no delay)
32K Program Memory board and Memory Allocation Control	A5 to B	A1 to A	Option (one wait state delay at $\geq 6.4\text{MHz}$) (c)

(a) Jumper configurations listed are for $< 8\text{ MHz}$ operation.

(b) Jumper configurations not listed for J1045 and J2045 are for future use.

(c) One wait state is equivalent to one extra clock cycle per memory cycle.

Section 4

THEORY OF OPERATION

INTRODUCTION

This section is divided into three parts. The first part is a general description of information flow through the 68000 Emulator Processor module. The second part is a block diagram overview of the module. This material includes functional-level descriptions and are supported by block diagrams and the schematic diagrams located at the rear of this manual. The third part is an example of a typical emulation cycle using the command "GO 100".

INFORMATION FLOW

The following text describes information flow between the 68000 Emulator Processor, the development system, and the prototype circuit (via the Prototype Control Probe). Connections between the Emulator Processor and the Prototype Control Probe are illustrated in Fig. 4-1. Refer to Section 9 of this manual for the 68000 Emulator Processor and Prototype Control Probe installation procedure.

EDGE CONNECTORS P1

The 68000 Emulator Processor has two circuit boards: EMU 1 and EMU 2. Each board has a connector labeled P1 (refer to Fig. 4-1). Because EMU 1 and EMU 2 are functionally one board, their connections to the development system are treated as one connection (refer to Fig. 4-2).

The development system data and address buses, and certain control lines, are connected to the Emulator Processor at P1. The data flow through P1 is bidirectional, and the data lines are buffered in both directions. Address flow through P1 is also bidirectional and buffered in both directions.

EDGE CONNECTOR SOCKET J2

The receptacle for the Cable Termination board is J2 on EMU 2 (refer to Fig. 4-1). Data and control flow are bidirectional and buffered in both directions. Address flow and buffering are from the Prototype Control Probe only (refer to Fig. 4-2).

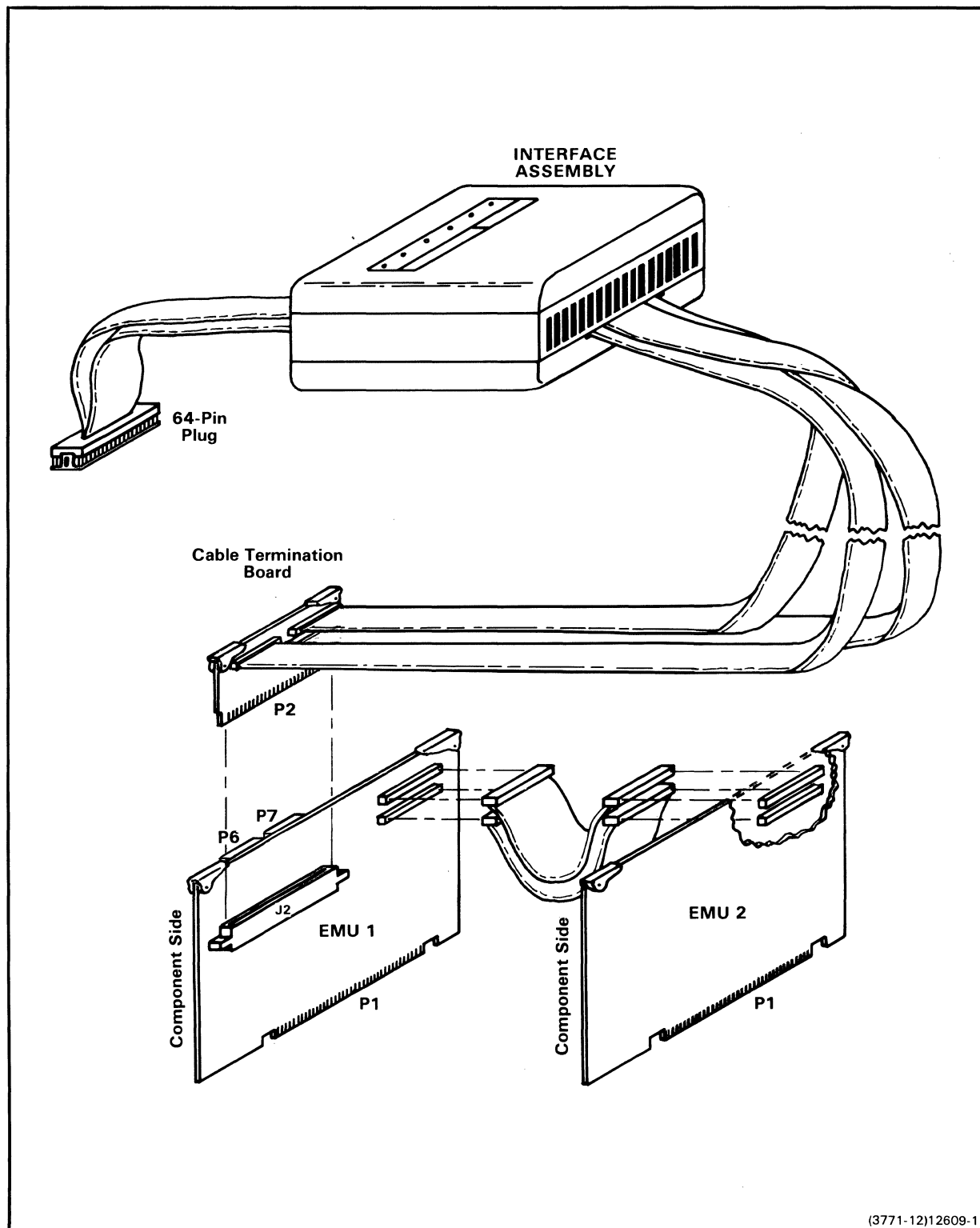


Fig. 4-1. 68000 Emulator Processor interconnections.

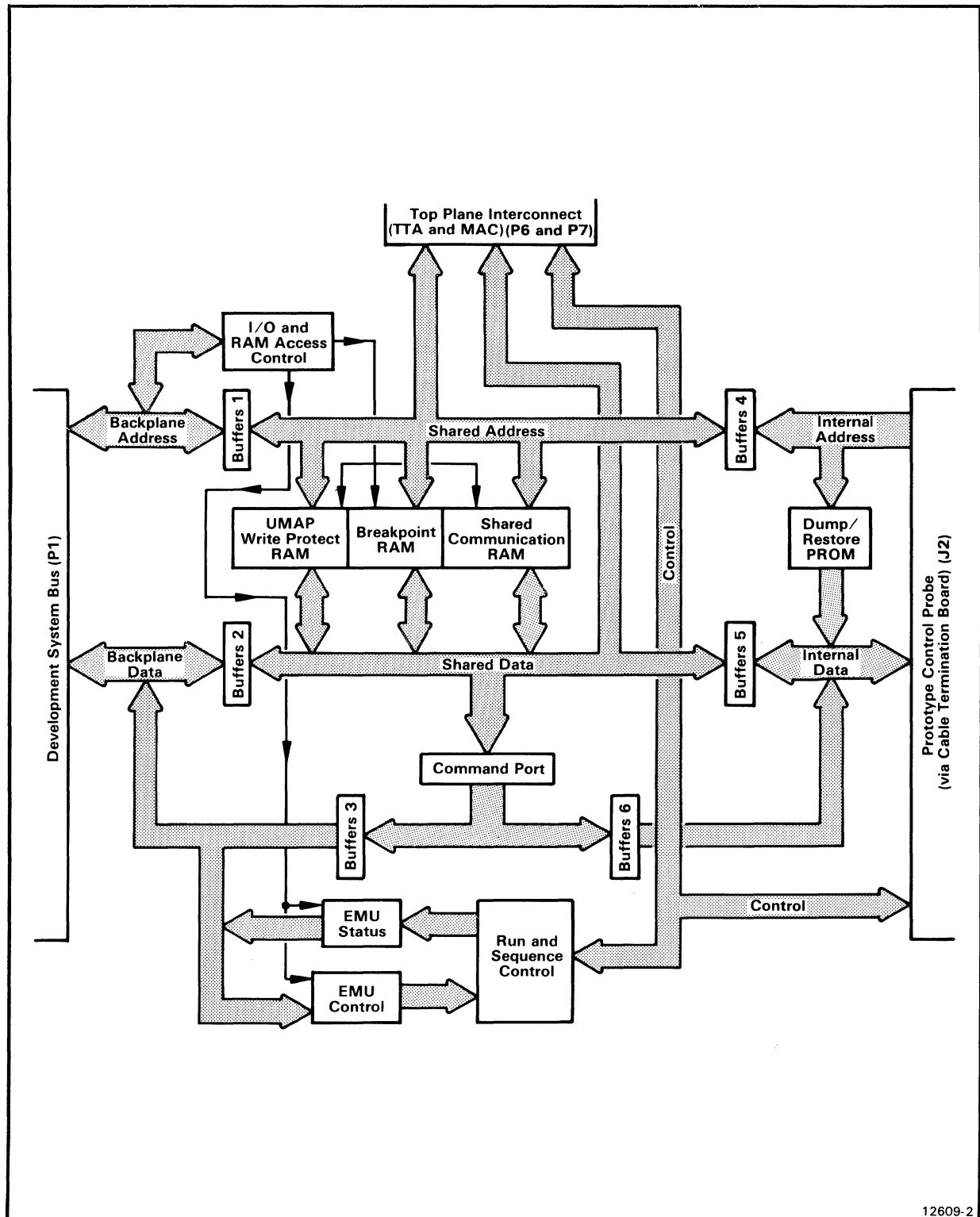


Fig. 4-2. 68000 Emulator Processor simplified block diagram.

P6 AND P7

Connections P6 and P7 (shown in Fig. 4-1) are referred to as the Top Plane Interconnect Bus. The optional Trigger Trace Analyzer (TTA) and Memory Allocation Control (MAC) board are connected to the Emulator Processor through the Top Plane Interconnect Bus. Address, data, and control signals flow over this bus and are not buffered (refer to Fig. 4-2).

PROTOTYPE CONTROL PROBE

The 68000 Prototype Control Probe contains address, data, and control line buffers, the microprocessor device, and driver/receiver devices. A 64-pin plug at the end of the Prototype Control Probe plugs into the 68000 microprocessor socket in the prototype circuit. When the Prototype Control Probe is plugged into the prototype circuit, the prototype sees the 68000 Emulator Processor as a 68000 microprocessor device.

MOBILE MICROPROCESSOR BOARD

The Mobile Microprocessor board, located in the Prototype Control Probe's Interface Assembly, contains the key element to emulation: a 68000 microprocessor device. The microprocessor device communicates with the rest of the system by way of edge connector P3.

EMULATOR PROCESSOR OVERVIEW

The 68000 Emulator Processor is used in the development of prototype hardware and software. Interface and multiplexing circuitry connect the 68000 microprocessor device, located on the Mobile Microprocessor board, to either the development system bus or the Prototype Control Probe. The 68000 Emulator Processor is controlled by the System Processor. For more information about the interaction of the various modules in the development system, refer to your development system's service manual.

The 68000 Emulator Processor supports four main operations:

- Communications between the development system and the Emulator Processor.
- Communications between the 68000 microprocessor and the Emulator Processor.
- Communications between the development system and the 68000 microprocessor.
- Communications between the Emulator Processor and the Top Plane Interconnect Bus.

Figure 4-2 is a simplified block diagram of the 68000 Emulator Processor. Although the Emulator Processor consists of two circuit boards (EMU 1 and EMU 2), it is functionally treated as a single board. Refer to Fig. 4-2 as you read this overview.

EMU STATUS PORT

The EMU Status Port (Fig. 4-2) consists of two bytes of information: Status byte and Auxiliary Status byte. By monitoring the two EMU Status Port bytes, the development system detects and displays any 68000 microprocessor stop or fail condition. This feature will assist you in debugging your prototype hardware and/or software.

The Status byte (Fig. 4-3) contains information about the 68000 microprocessor's running status. The most important function of this byte is to inform the development system when the 68000 microprocessor has halted and can not be started by the normal sequence. (The Emulator's normal starting sequence is discussed under the heading "A Typical Emulation Cycle", later in this section.)

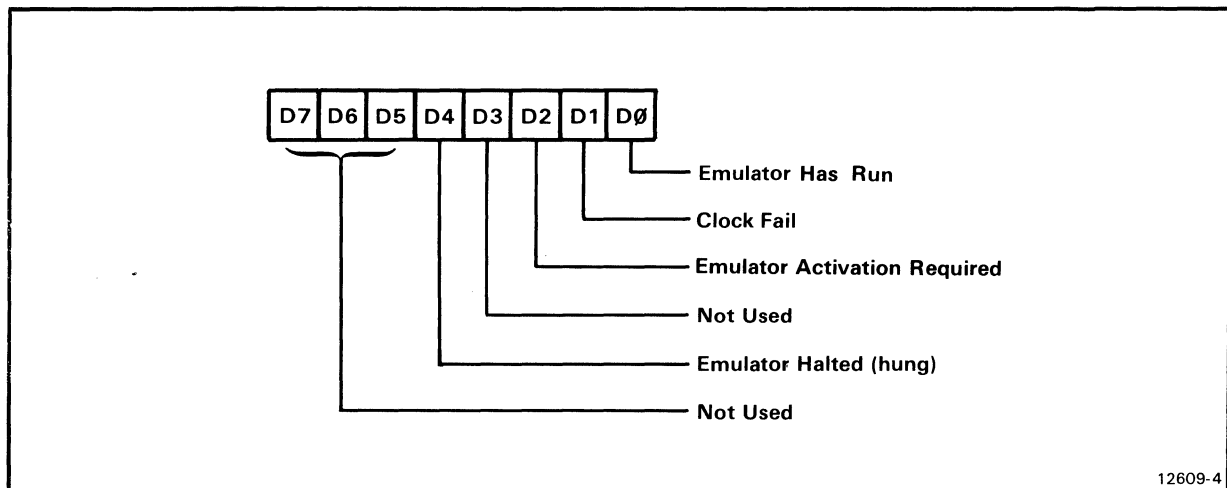


Fig. 4-3. Status byte.

The Auxiliary Status byte (Fig. 4-4) contains information about what condition has stopped the 68000 microprocessor. This byte can be read by the development system only once; the act of reading this byte clears its contents.

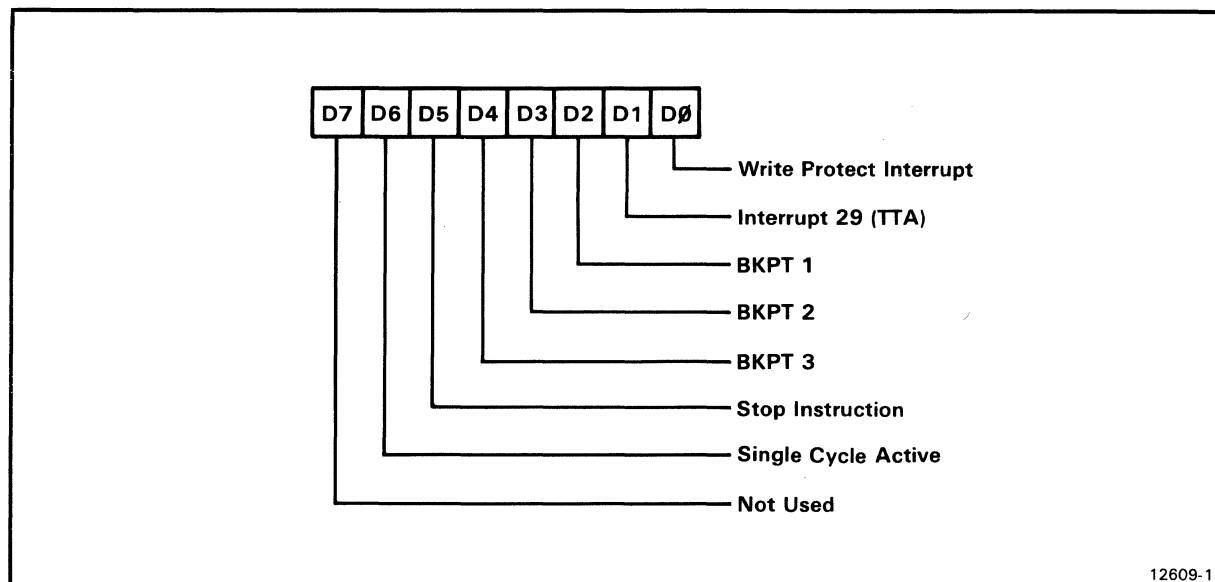


Fig. 4-4. Auxiliary Status byte.

EMU CONTROL PORT

The EMU Control Port (Fig. 4-2) consists of two bytes of information: Control byte and Auxiliary Control byte. These two bytes are illustrated in Fig. 4-5 and Fig. 4-6 respectively. The development system controls the 68000 microprocessor through the EMU Control Port bytes.

The Control byte (Fig. 4-5) contains information such as:

- Select (probe power on) the 68000 microprocessor.
- Select the emulation mode: Mode 0, 1, or 2 (as shown in Table 4-1)
- Enable 2650 access to the Shared Communication RAM.
- Activate the Emulator Processor.

The Auxiliary Control byte (Fig. 4-6) contains information such as:

- Enable the 68000 microprocessor to detect SVCs (service calls).
- Breakpoint 1 arms breakpoint 2.
- Single step the 68000 microprocessor.
- Forced Function Code values used during UGET and UPUT operations by the probe. This allows the prototype to access the separate memory spaces of the 68000 microprocessor (Table 4-2).

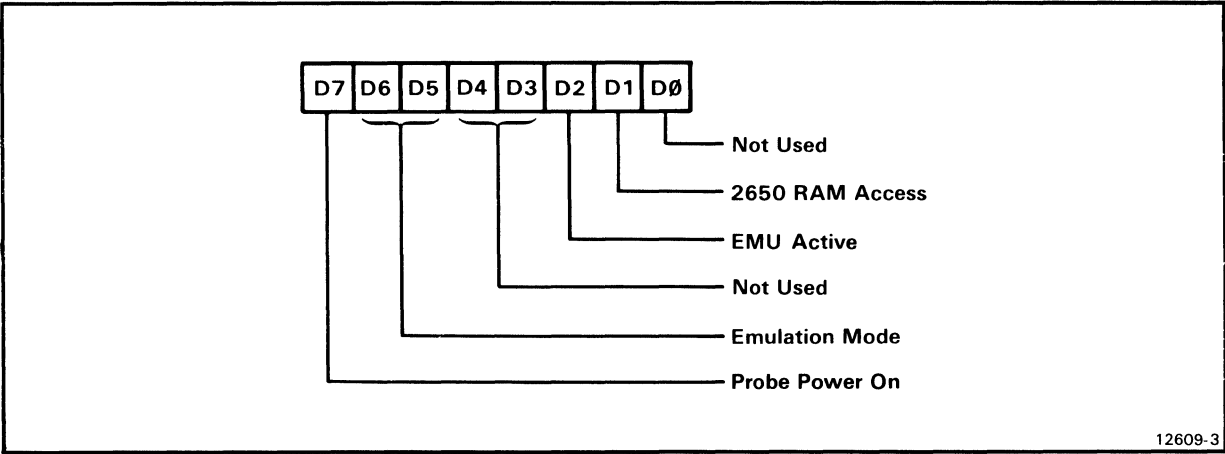


Fig. 4-5. Control byte.

Table 4-1
Emulation Mode Encoding

D6 D5		Function
L	L	Mode 0
L	H	Mode 1
H	H	Mode 2

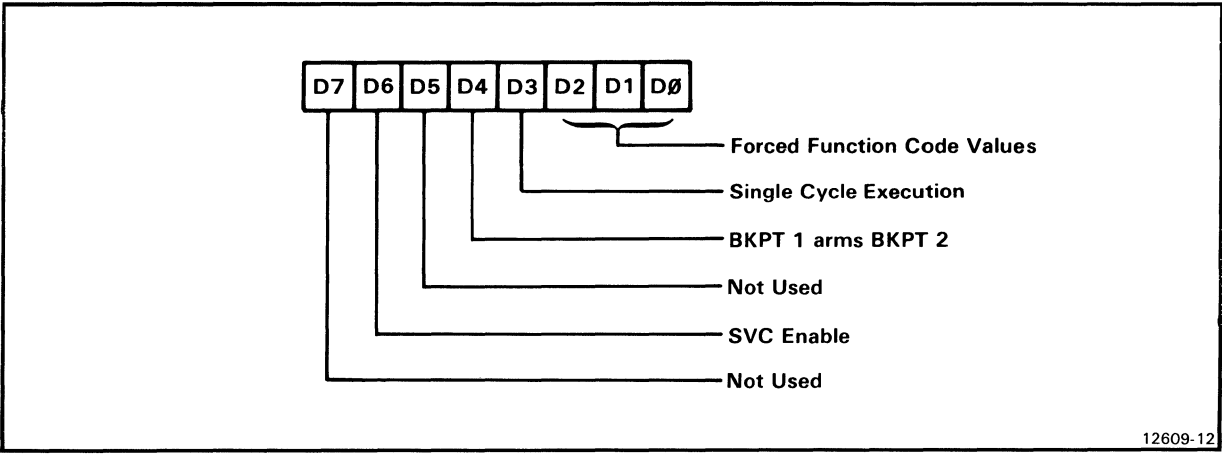


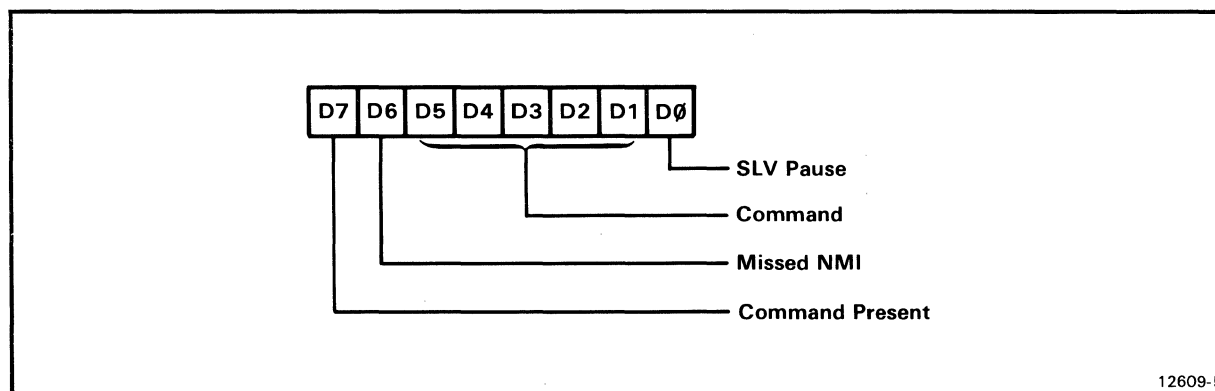
Fig. 4-6. Auxiliary Control byte.

Table 4-2
Forced Function Code Encoding

Forced Function Codes			Memory Space
FFC2	FFC1	FFC0	Accessed
0	0	0	Not Used
0	0	1	User Data
0	1	0	User Code
0	1	1	Not Used
1	0	0	Not Used
1	0	1	Supervisor Data
1	1	0	Supervisor Code
1	1	1	Interrupt

COMMAND PORT

The Command Port (Fig. 4-2) consists of one byte of information (Fig. 4-7). The development system loads the Command Port with a command (Table 4-3) for the 68000 Emulator Processor. The command data tells the 68000 microprocessor to perform one subroutine out of Dump and Restore PROM (discussed later in this section).



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Fig. 4-7. Command Port byte.

Table 4-3
Command Encoding

D5	D4	D3	D2	D1	Command
L	L	L	L	L	Return to user program
L	L	L	L	H	Register Dump
L	L	L	H	L	Register Restore
L	L	L	H	H	UPUT
L	L	H	L	L	UGET
L	L	H	L	H	Readback check
L	L	H	H	L	Execute from Dump and Restore RAM
L	L	H	H	H	Reserved for future use
H	X	X	X	X	Reserved for future use (a)
X	H	X	X	X	Reserved for future use (a)

(a) X = don't care

RUN/SEQUENCE CONTROL

The Run/Sequence Control logic (Fig. 4-2) is the interpreter between the Emulator Processor and EMU Status. Several control lines bring 68000 microprocessor status information to Run/Sequence Control from various parts of the Emulator Processor. The Run/Sequence Control circuitry converts the control signals into status signals. These status signals are fed from the Run/Sequence Control to the EMU Status port (discussed earlier in this section).

Run/Sequence Control logic is also the interpreter between EMU Control and the Emulator Processor. Run/Sequence Control receives control signals from the EMU Control port (discussed earlier in this section). Run/Sequence Control logic processes these signals into different control signals needed to operate the Emulator Processor. The processed signals are driven to the various sections of the Emulator Processor to provide proper timing and control.

Run/Sequence Control logic performs one other function: it determines whether the Emulator Processor is to execute user program or Dump and Restore subroutines (discussed later in this section).

I/O AND RAM ACCESS CONTROL

The I/O and RAM Access Control logic (Fig. 4-2) decodes the development system's address information into control signals. According to the address information these control signals allow the development system to access:

- The Breakpoint RAM.
- The Shared Communication RAM.
- The UMAP/Write Protect RAMs.
- The EMU Status port.
- The EMU Control port.

RAM

Three different blocks of RAM (Fig. 4-2) are used in the 68000 Emulator Processor: Breakpoint, Shared Communication, and UMAP/Write Protect. The development system (2650) accesses the RAMs as shown in Table 4-4 and Table 4-5. The specific RAM accessed by the 2650 is determined by the I/O and RAM Access Control logic (discussed earlier in this section). For more information on how the following RAMs are accessed and utilized, refer to the "Development System/Emulator Processor Communication" and "Microprocessor/Emulator Processor Communication" discussions, later in this section.

Breakpoint RAM

The 68000 Emulator Processor cannot use the breakpoint circuitry on the development system's Emulator Controller board. Therefore, a RAM-based breakpoint comparator is incorporated into the Emulator Processor's circuitry (Fig. 4-2). This breakpoint comparator consists of four 256 X 4-bit RAMs located on EMU 2.

As shown in Table 4-4 a portion of the 2650's address range (8000--83FF) is designated for use by the four Breakpoint RAMs. Table 4-6 lists the addresses used by each RAM device. When the 68000 microprocessor is not running your programs, the 2650 can program the breakpoint RAMs with an address at which a breakpoint (BKPT) or Service Call (SVC) is to occur. If a BKPT is to occur, then the distinction between a BKPT 1, BKPT 2, or BKPT 3 is also included in the information loaded.

Table 4-4
Emulator Processor RAM Partitioning

2650 Address Space Allocation	68000 Emulator Processor RAM
8000--82FF	Breakpoint RAM
8300--83DF	Not Used
83E0--83FF	Breakpoint RAM
8400--9FFF	Not Used (a)
A000--A7FF	Shared Communication RAM
A800--BFFF	Not Used (b)
C000--FFFF	UMAP/Write Protect RAM

(a) Contains Breakpoint RAM images.

(b) Contains Shared Communication RAM images.

The 68000 microprocessor's address lines and some control lines are also divided into four parts, one part for each of the four BKPT RAMs (Table 4-6). While your programs are running, the 68000 microprocessor's address and control lines are presented to and monitored by the BKPT RAMs. When an address presented to the BKPT RAMs equals the address previously loaded by the 2650 the appropriate BKPT or SVC occurs by way of the BKPT RAM data output lines (Table 4-7).

Table 4-5
2650 RAM Access Bit Encoding

2650 Address Lines									Emulator Processor RAM Accessed
A15	A14	A13	A12	A11	A10	A9	A8	A7--A0	
1	0	0	0	0	0	0	0	(a)	BKPT RAM (U3050)
1	0	0	0	0	0	0	1	(a)	BKPT RAM (U3070)
1	0	0	0	0	0	1	0	(a)	BKPT RAM (U3080)
1	0	0	0	0	0	1	1	(a)	BKPT RAM (U3090)
1	0	1	0	0			(a)		Shared Communication RAM
1	1	0	0			(a)			UMAP/Write Protect RAM (User Code)
1	1	0	1			(a)			UMAP/Write Protect RAM (User Data)
1	1	1	0			(a)			UMAP/Write Protect RAM (Supervisor Code)
1	1	1	1			(a)			UMAP/Write Protect RAM (Supervisor Data)

(a) Binary address that is presented directly to the RAMs.

Table 4-6
Breakpoint RAM Partitioning

2650 Address Space	Breakpoint RAM Circuit Number	68000 Microprocessor Address and Control Lines
8000--80FF	U3050	A7--A0
8100--81FF	U3070	A15--A8
8200--82FF	U3080	A23--A16
83E0--83FF	U3090	R/W, B/W, FC2, FC1, and FC0

Table 4-7
Breakpoint RAM Data Out

Data Lines	Description
D1(L)	BKPT 1
D2(L)	BKPT 2
D3(L)	BKPT 3
D4(L)	SVC

Shared Communication RAM

The Shared Communication RAM (Fig. 4-2) serves as a buffer memory for data transfers between the 2650 and the 68000 microprocessor. A portion of the 2650's address space (Table 4-4), A000--A7FF, and the 68000 microprocessor's address space, 0800--0FFF, are used to access the Shared Communication RAM.

Table 4-8 is a memory map of the Shared Communication RAM. Refer to Table 4-8 as you read the following discussion.

Theory of Operation - 68000 E.P. Service

The Shared Communication RAM is used for the following six major data transfer operations:

- **Register Dump**
The 68000 microprocessor loads its register values into the Shared Communication RAM's Register Save, Supervisor Stack Pointer, User Stack Pointer, Status Register, and PC Next areas. The 2650 then copies these registers by way of A000--A049 to the system memory's RSAVE area. The register values are then displayed on your development system terminal.
- **Register Restore**
The inverse of Register Dump: the 2650 loads the Shared Communication RAM with register values to be used by the 68000 microprocessor. The 68000 microprocessor copies these values into its registers for future use.
- **UGET**
The 68000 microprocessor accesses the prototype memory and transfers a block of data to the Shared Communication RAM's Buffer Block area (see Table 4-8). The block of data to be transferred is defined within the Shared Communication RAM's Prototype Address, Byte Count, and Byte/Word areas. The Prototype Address area contains the transferring block's starting address. The Byte Count area contains the number of bytes to be transferred. The Byte/Word area determines whether the transferring block is byte or word oriented. The 2650, using these same parameters, then transfers the block of data from the Buffer Block area into the development system's program memory.
- **UPUT**
The inverse of UGET: a block of program memory from the development system is relocated to prototype memory.
- **Starting the Emulator Processor**
The 68000 microprocessor builds a stack in the Shared Communication RAM's Interrupt Trapstack (Table 4-8). The Trapstack consists of PC Next and Status Register based on the Supervisor Stack Pointer value. Upon executing an RTE instruction the 68000 microprocessor unstacks from the Trapstack and begins executing user program at the unstacked PC Next with the correct Status Register. For more information on starting the Emulator Processor refer to the discussion under the heading "A Typical Emulation Cycle", later in this section.

Table 4-8
Shared Communication RAM Memory Map

2650 Address	Shared Communication	68000 Microprocessor	
Space	RAM Contents	Address Space	Registers
A000--A003	Register Save	0800--0803	D0
A004--A007		0804--0807	D1
A008--A00B		0808--080B	D2
A00C--A00F		080C--080F	D3
A010--A013		0810--0813	D4
A014--A017		0814--0817	D5
A018--A01B		0818--081B	D6
A01C--A01F		081C--081F	D7
A020--A023		0920--0823	A0
A024--A027		0924--0827	A1
A028--A02B		0928--082B	A2
A02C--A02F		092C--082F	A3
A030--A033		0930--0833	A4
A034--A037		0934--0837	A5
A038--A03B		0938--083B	A6
A03C--A03F	Supervisor Stack Pointer	083C--083F	
A040--A043	User Stack Pointer	0840--0843	
A044--A045	Status Register	0844--0845	
A046--A047	PC Next (High)	0846--0847	
A048--A049	PC Next (Low)	0848--0849	
A04A--A04B	NMI Missed (Flag)	084A--084B	
A04C--A04F	Prototype Address	084C--084F	
A050--A051	Byte Count	0850--0851	
A052--A053	Byte/Word	0852--0853	
A054--A055	Command Completion Status	0854--0855	
A056--A059	Error Address	0856--0859	
A05A--A7F5	Buffer Block	085A--0FF5	
A7F6--A7F7	PROM Stack	0FF6--0FF7	
A7F8--A7FF	Interrupt Trapstack	0FF8--0FFF	

- Stopping the Emulator Processor
The hardware on the Emulator Processor catches the PC Next and Status Register values and loads them into the Shared Communication RAM's Trapstack area. The 68000 microprocessor then moves the PC Next and Status Register values from the Trapstack area to the PC Next and Status Register areas respectively. The 68000 microprocessor, then loads the Command Completion Status area to indicate that command execution has completed.

UMAP/Write Protect RAM

Mapping of program memory and prototype memory is controlled by the 2650 through a RAM-based map/write protect comparator incorporated into the Emulator Processor's circuitry (Fig. 4-2).

The UMAP/Write Protect comparator consists of eight 256 X 2-bit RAMs located on EMU 2. Table 4-9 shows how the eight RAMs are used. A portion of the 2650's address range (Table 4-4), C000--FFFF, is divided into four parts. Each part is designated for use by two of the eight UMAP/Write Protect RAMs (Table 4-9). When the 68000 microprocessor is not running user programs, the 2650 can program the UMAP/Write Protect RAMs.

The UMAP/Write Protect RAMs are programmed and executed in the same way as the Breakpoint RAMs (discussed earlier in this section), except for the use of different parameters. The parameters used by the UMAP/Write Protect RAMs are listed in Tables 4-10 and 4-11.

DUMP AND RESTORE PROM

The Dump and Restore (D/R) PROM (Fig. 4-2) contains 68000 microprocessor subroutines. Each of these subroutines has its own address. When an Emulator Processor command is present in the Command Port, the 68000 microprocessor jumps to the appropriate subroutine in the D/R PROM. Each subroutine provides the means by which the 68000 microprocessor can execute the command contained in the Command Port.

Table 4-9
UMAP/Write Protect RAM Partitioning

2650 Address Space	Memory Space Accessed	Circuit Numbers	RAM Function
C000--CFFF	User Data	U3010	Mapping
		U4010	Write Protect
D000--DFFF	User Code	U3020	Mapping
		U4020	Write Protect
E000--EFFF	Supervisor Data	U3030	Mapping
		U4030	Write Protect
F000--FFFF	Supervisor Code	U3040	Mapping
		U4040	Write Protect

Table 4-10
UMAP/Write Protect RAM Data Out

Data Lines		Description	
D1	D0	Write Protect	Map to:
0	0	Yes	Prototype Memory
0	1	Yes	Program Memory
1	0	No	Prototype Memory
1	1	No	Program Memory

Table 4-11
Addresses Presented to the UMAP/Write Protect RAMs

2650 Address Lines	68000 Microprocessor Address Lines
A13	FC2
A12	FC1
A11	A23
A10	A22
A9	A21
A8	A20
A3	A19
A2	A18
A1	A17
A0	A16
A7	A15
A6	A14
A5	A13
A4	A12

DEVELOPMENT SYSTEM/EMULATOR PROCESSOR COMMUNICATION

When the development system communicates with the Emulator Processor, buffers 1 and 2 (illustrated in Fig. 4-2) are switched on and all other buffers are switched off. This allows the development system access to the RAMs (via the Shared Address bus and Shared Data bus). After the development system has accessed the RAMs, it then writes a command to the Command Port. Buffers 1 and 2 are switched off; buffers 4 and 5 are switched on. This gives control of the Emulator Processor's shared address and data buses to the 68000 microprocessor.

While the microprocessor is communicating with the Emulator Processor, the development system monitors the EMU Status port and Command Port to see if the microprocessor has stopped running or finished executing a command. If the microprocessor does stop running, EMU Status tells the development system why. Also, because buffers 3 and 6 are switched on, the development system and microprocessor monitor the Command Port at the same time. This lets the development system know when the microprocessor has finished executing the command. It also lets the microprocessor know when the development system has given it a command.

The development system also provides control information to the 68000 microprocessor via the EMU Control port.

MICROPROCESSOR/EMULATOR PROCESSOR COMMUNICATION

The Run/Sequence Control tells the 68000 microprocessor when it is selected. The Dump and Restore (D/R) PROM provides the steps that the microprocessor must perform to execute a command. When the microprocessor has been instructed to run, buffers 3 and 6 are the only buffers switched on. The microprocessor reads a command from the Command Port via buffer 6; the development system monitors the Command Port via buffer 3. With a command to execute (and the D/R PROM providing the instructions), buffers 4 and 5 are switched on, qualified by a read or write. This allows the microprocessor to access the RAMs and to read and/or write address/data according to the command received. When the microprocessor has completed the instructions necessary to execute the command, it writes data to the Command Port indicating that command execution is complete. This allows the development system to take control.

MICROPROCESSOR/DEVELOPMENT SYSTEM COMMUNICATION

The 68000 microprocessor and the development system may communicate with each other directly. Direct communication will occur when the Emulator Processor is instructed to execute your program. To accomplish this, buffers 1 and 4 are switched on in the direction of the development system and buffers 2 and 5 are switched on, qualified by a read or write. Buffers 3 and 6 are switched off.

EMULATOR PROCESSOR/TOP PLANE COMMUNICATION

As illustrated in Fig. 4-2, the Top Plane Interconnect Bus has access to all information presented to the Shared Address, Shared Data, and Control lines.

A TYPICAL EMULATION CYCLE

The 68000 Emulator Processor performs four basic operations to complete a typical emulation cycle. The four basic operations are: reset sequence, starting the emulator, running the emulator, and stopping the emulator. Each of these operations is discussed here, using a "GO 100" command as an example.

In this discussion, assume that the Emulator Processor is being used in an 8550 Microcomputer Development Lab. Assume also that the Emulator Processor is selected and operating in Emulation Mode 0.

RESET SEQUENCE

There are two different reset levels for the 68000 Emulator Processor: the 'Emulator' reset and the 'Microprocessor' reset. The 'Emulator' reset is used to reset the 68000 Emulator Processor. The 'Microprocessor' reset is used to reset only the 68000 microprocessor.

Emulator Reset

If the Probe Power On bit (D7) of the Control byte (refer to Fig. 4-8) is turned off, the Emulator Processor turns off the power to the Interface Assembly. To complete an Emulator reset, the 68000 microprocessor requires approximately 0.1 second. The sequence of events for an Emulator reset is as follows:

1. The System Controller (2650) writes to the Control byte to set the emulation mode (D6 and D5), and clear the Probe Power On bit (D7) and EMU Active bit (D2).
2. The 2650 writes to the Control byte to assert the Probe Power On bit (D7). The Emulator Processor turns on the power to the Interface Assembly.
3. The 2650 waits for 0.1 second, then asserts the EMU Active bit (D2).

This completes the Emulator reset. The Emulator reset is required whenever the Probe Power On bit has been turned off. (Examples of commands that turn the Probe Power On bit off are: SEL, EDIT, and ASM.)

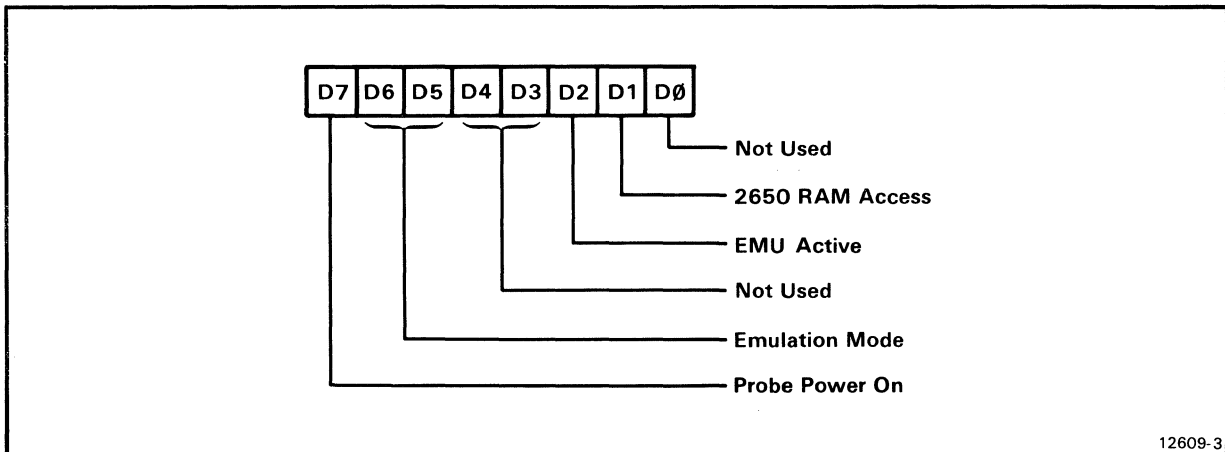


Fig. 4-8. Control byte.

Microprocessor Reset

The Microprocessor reset is required whenever the emulation mode is changed or the 68000 microprocessor halts. The Status byte bit D2 (refer to Fig. 4-9) indicates whether an Emulator reset (D2=1) or a Microprocessor reset (D2=0) is required. When a Microprocessor reset is performed:

1. The EMU Active bit (D2) in the Control byte is cleared.
2. The EMU Active bit (D2) in the Control byte is asserted.

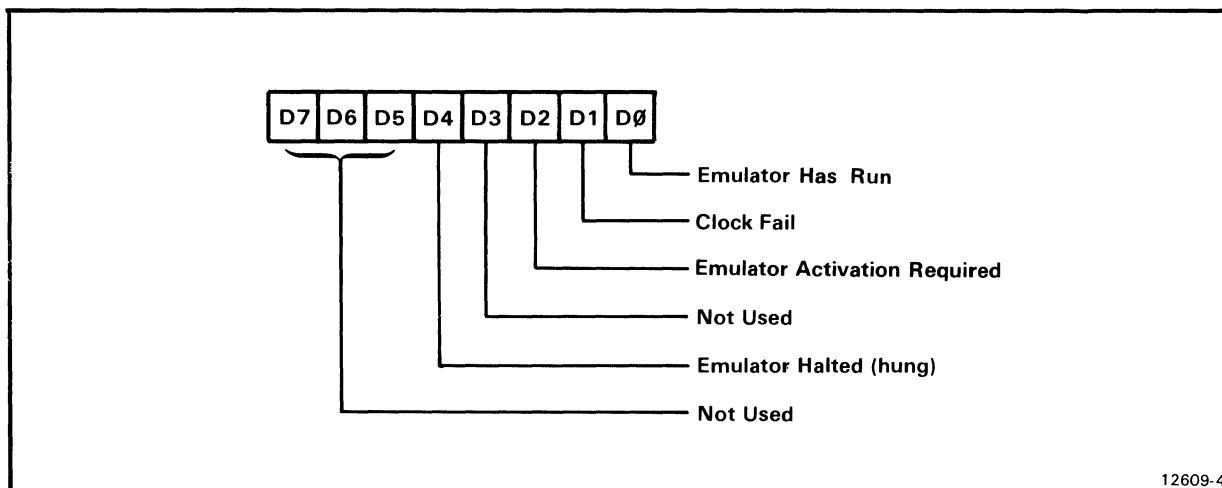


Fig. 4-9. Status byte.

STARTING THE EMULATOR

Assume the following commands are entered at the system terminal:

```
>S SSP=67FE SR=2700 (These values become the register image)
>GO 100
```

No action is taken until "GO 100" is entered (followed by a return). The System Processor then restores the 68000 microprocessor's registers, as follows:

1. The 2650 enables its access to the Shared Communication RAM by asserting D1 at the Control Port.
2. The 2650 then loads the Shared Communication RAM with the register image (SSP=67FE and SR=2700).
3. The 2650 writes a Register Restore command to D1--D5 in the Command Port (see Fig. 4-10). The 2650 then polls the Command Port until the 68000 microprocessor has finished executing the Register Restore command. Note that the Status Port (Fig. 4-9) will also be checked to see if there has been an Emulator Processor fault (D1 or D4).
4. The 68000 microprocessor responds to the Register Restore command by building a new control stack in the "Trapstack" (upper four words in the Shared Communication RAM; refer back to Table 4-8). This stack is built by taking the desired Supervisor Stack Pointer (SSP) 67FE, stacking the Program Counter (PC) to equal 100 and Status Register (SR) to 2700 in the Trapstack. After a Return from Exception (RTE), the 68000 microprocessor will be in the correct state. The 68000 microprocessor will then load the remaining registers from the register area of the Shared Communication RAM. The 68000 microprocessor clears the Command Port (D7--D1) when the Register Restore command has been executed.

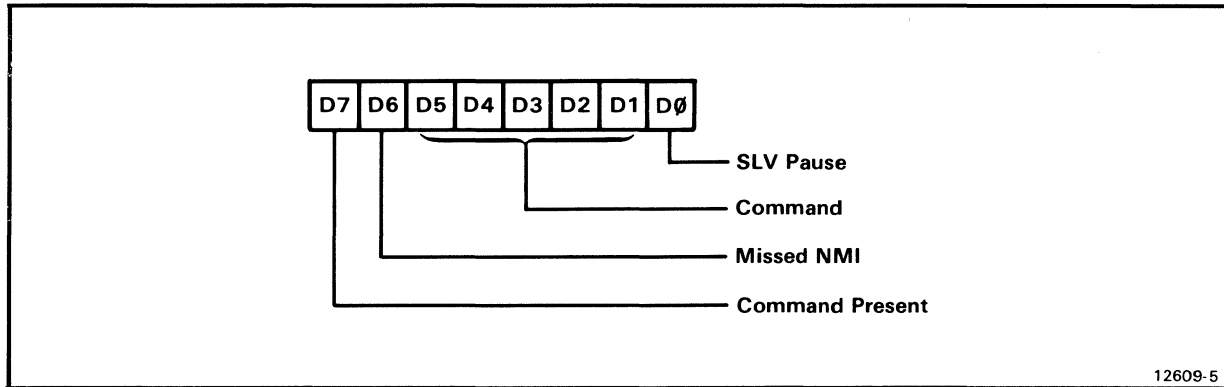


Fig. 4-10. Command Port byte.

RUNNING THE EMULATOR

The 68000 Emulator Processor executes a user program in the following manner:

1. The 2650 issues the run-user program command by writing the appropriate command to D1--D5 in the Command Port. The 68000 Emulator Processor responds by switching the buffers so that the 68000 microprocessor has access to the Shared Communication RAM. At this time, the 68000 microprocessor drops from the command present polling loop into a wait for deassertion of SLV PAUSE (Command Port D0) polling loop.
2. The 2650 executes a HALT instruction and the emulator controller clears SLV PAUSE. The Emulator Processor "sees" this in the polling loop, and branches to the RTE instruction in the special area of the Dump and Restore (D/R) PROM. This enables the run-user-program sequence. The 68000 microprocessor then executes a RTE instruction, retrieving the PC and Status Register from the "Trapstack". This transfers control to the user program at PC=100 and SR=2700.

STOPPING THE EMULATOR

Whenever a system interrupt occurs the Emulator Processor stops executing your program and returns control to the 2650. The interrupt may come from a number of sources: the Emulator Processor itself, a keyboard interrupt, timer interrupt, I/O interrupt, or any other system interrupt.

There are two major types of interrupts: non-debug interrupts and debug interrupts.

Non-Debug Interrupts

Non-debug interrupts assert SLV PAUSE. This has no effect on the emulation process, since the emulator control software just resumes emulation by calling the halt routine. Non-debug interrupts originate from the following sources:

- Keyboard (other than CTRL-C)
- Timer
- I/O

Debug Interrupts

Debug interrupts require service by the emulator control software or firmware. These interrupts indicate that some change of control is required. The following sources may generate debug interrupts:

1. Emulator Processor: breakpoint, service call, write protection violation, or any Emulator Processor fault (such as clock, power, and halt)
2. Memory Allocation Controller (tried to access non-existent memory)
3. Trigger Trace Analyzer (encounters a breakpoint)
4. CTRL-C (CTRL and C keys pressed simultaneously)

When the 2650 is activated, it first executes the appropriate interrupt service routine, then resumes execution of the emulator control software immediately after the halt instruction.

NOTE

It is possible that more than one interrupt may cause the Emulator Processor to stop (such as a BKPT and CTRL-C). The emulator control software will check all possible conditions to determine priority of action.

When the 68000 Emulator Processor receives an interrupt (non-debug or debug) a Non-Maskable Interrupt (NMI) to the 68000 microprocessor is asserted.

Theory of Operation - 68000 E.P. Service

When the interrupt is acknowledged, the Emulator Processor blocks the 68000 microprocessor from running the user program, and forces the 68000 microprocessor to run out of the Dump and Restore (D/R) PROM. The D/R PROM routine then clears the run-user-program command from the Command Port and begins polling the Command Port to await further commands from the 2650.

The 2650 reads the Status Port on the Emulator Processor to determine the cause(s) of the break (Emulator Processor Halted).

In the case of a non-debug interrupt, the 2650 issues a Dump Register command to the Command Port. The 68000 microprocessor executes the Dump Register routine out of the D/R PROM. (The 68000 microprocessor dumps its register values into the Shared Communication RAM.) When the Dump Register routine is completed, the 68000 microprocessor clears the Command Port. The 2650 then reads the register values in the Shared Communication RAM, and displays these values on the system terminal.

Section 5FUNCTIONAL CHECK PROCEDURESINTRODUCTION

This section tells how to verify the operation of the 68000 Emulator Processor installed in an 8550 Microcomputer Development Lab or an 8540 Integration Unit. To perform verification with the 8550, you'll need a system terminal (connected to the 8301), and the 8550 system diagnostics disc. To perform verification with the 8540, you'll need a system terminal (connected to the 8540), and the 68000 Diagnostics PROM.

This section is not intended to give you a detailed description of the 8550 disc-resident diagnostics or the 8540 ROM-resident diagnostics. The information provided here gives you a procedure to verify the operation of the 68000 Emulator Processor in the quickest way possible.

For more detailed information about your system's disc-resident or ROM-resident diagnostics, refer to the following manuals:

- 8550 Microcomputer Development Lab Installation Guide
- 8540 Integration Unit Installation Guide

Also useful are the following optional manuals:

- 8301 Microprocessor Development Unit Service Manual
- 8550 Microcomputer Development Lab Service Manual
- 8540 Integration Unit Service Manual

8550 MICROCOMPUTER DEVELOPMENT LAB VERIFICATION

When both the 8501 and 8301 have displayed "boot" messages on the system terminal, you're ready to run the 8550 disc-resident diagnostics.

PROCEDURE

To verify 68000 Emulator Processor operation, perform the following procedure:

1. Insert the 8550 system diagnostics disc (label side up) into drive 0 (top drive) of the 8501.

Functional Check Procedures - 68000 E.P. Service

2. Close the disc-drive door.
3. Within 6 seconds, the 8501 will begin a preliminary read of the disc.
4. The system terminal will display the following information:

```
8301 BOOT V x.x
8501 V x.x
8301 BOOT V x.x
```

5. The 8501 will begin reading the disc again.
6. Approximately 12 seconds later, the diagnostic greeting message and first menu will appear on the system terminal. The message and menu are shown in Display 5-1.

```
*****
*
*      TEKTRONIX INC.
*      8550 DISC-RESIDENT DIAGNOSTIC SYSTEM
*      VERSION X.X
*      Copyright (c) 1981 Tektronix, Inc.
*
*****

*** 8301 DIAGNOSTIC EXECUTIVE VERSION X.X - LOADED ***

      RUN MODE MENU
      -----

1 - AUTOMATIC MODE   *** default ***
2 - SELECT MODE
H - HELP

Type in desired mode: {<CR>} or {1, 2, or H and <CR>}?_
```

Display 5-1

As soon as the system terminal displays the diagnostic greeting message and RUN MODE MENU, press the RETURN key to select the AUTOMATIC MODE (System Verification). Immediately, another menu is displayed: AUTOMATIC MODE MENU. Press the RETURN key again to select the DISPLAY OPTION menu. Press the RETURN key a third time, to start execution of the AUTOMATIC SYSTEM VERIFICATION tests. No further operator intervention is required.

Various "test running" messages for both the 8301 and 8501 are displayed while the verification tests are executing. The 8301 (including the 68000 Emulator Processor) is tested first, followed by the 8501. The diagnostic tests take a total of approximately ten minutes to execute. At the end of that time, the system terminal will display either of two messages:

SYSTEM VERIFICATION PASSED

or

SYSTEM VERIFICATION FAILED

If the SYSTEM VERIFICATION FAILED message is displayed, refer to the 8301 Microprocessor Development Unit Service Manual and 8501 Data Management Unit Service Manual for information on performing exhaustive diagnostic troubleshooting.

This completes the functional test procedure for the 68000 Emulator Processor.

8540 INTEGRATION UNIT VERIFICATION

PROCEDURE

1. If the 68000 Emulator Processor was factory-installed in your 8540, the 68000 Diagnostics PROM is already installed. If not, you'll have to insert the 68000 Diagnostics PROM into the 8540 Integration Unit. Refer to the 8540 Integration Unit Installation Manual for this procedure.
2. Make sure that the Mode Selector switch on the System Controller board is in its normal operating configuration: switch positions 0--2 and 4--7 set to 0, switch position 3 set to 1.
3. Power up the 8540.
4. After the 8540 has displayed its boot message on the system terminal, you're ready to run the 8540 ROM-Based Diagnostics.

5. At the system terminal, enter:

> SELECT DIAGS <CR>

The system terminal will display the diagnostic greeting and the Run Mode Menu, as shown in Display 5-2.

```
*****
*                                     *
*   TEKTRONIX INC.                   *
*   8540 ROM-RESIDENT DIAGNOSTIC SYSTEM *
*   VERSION X.X                      *
*   Copyright (c) 1981 Tektronix, Inc. *
*                                     *
*****
```

RUN MODE MENU

```
1 - AUTOMATIC MODE      ***** Default *****
2 - SELECT MODE
```

Type mode :

Display 5-2

As soon as the system terminal displays the diagnostic greeting message and RUN MODE MENU, press the RETURN key to select the AUTOMATIC MODE (System Verification). Immediately, another menu is displayed: AUTOMATIC MODE MENU. Press the RETURN key again to select the DISPLAY OPTION menu. Press the RETURN key a third time, to start execution of the AUTOMATIC SYSTEM VERIFICATION tests. No further operator intervention is required.

Functional Check Procedures - 68000 E.P. Service

Various "test running" messages are displayed while the verification tests are executing. The diagnostic tests take a total of approximately ten minutes to execute. At the end of that time, the system terminal will display either of two messages:

SYSTEM VERIFICATION PASSED

or

SYSTEM VERIFICATION FAILED

If the SYSTEM VERIFICATION FAILED message is displayed, refer to the 8540 Integration Unit Service Manual for information on performing exhaustive diagnostic troubleshooting.

This completes the functional test procedure for the 68000 Emulator Processor.

Section 6

ADJUSTMENT PROCEDURES

PROTOTYPE CONTROL PROBE POWER SUPPLY CALIBRATION

The 68000 Prototype Control Probe's power supply board generates two regulated supply voltages: +4.92 Vdc and +5 Vdc. The +4.92 Vdc supplies voltage for much of the Interface Assembly circuitry. The +5 Vdc is only used by the 64-pin plug. Both of these voltages are adjustable and may require occasional calibration.

EQUIPMENT REQUIRED

- TEKTRONIX microcomputer development system, with the 68000 Emulator Processor and Prototype Control Probe installed
- DVM with 100 μ V resolution and $\pm 0.1\%$ accuracy (TEKTRONIX DM501 or equivalent)

PROCEDURE

1. Ensure that primary power (115 Vac or 230 Vac) to the development system is OFF.
2. Remove the four screws at the corners on the bottom of the Interface Assembly housing.

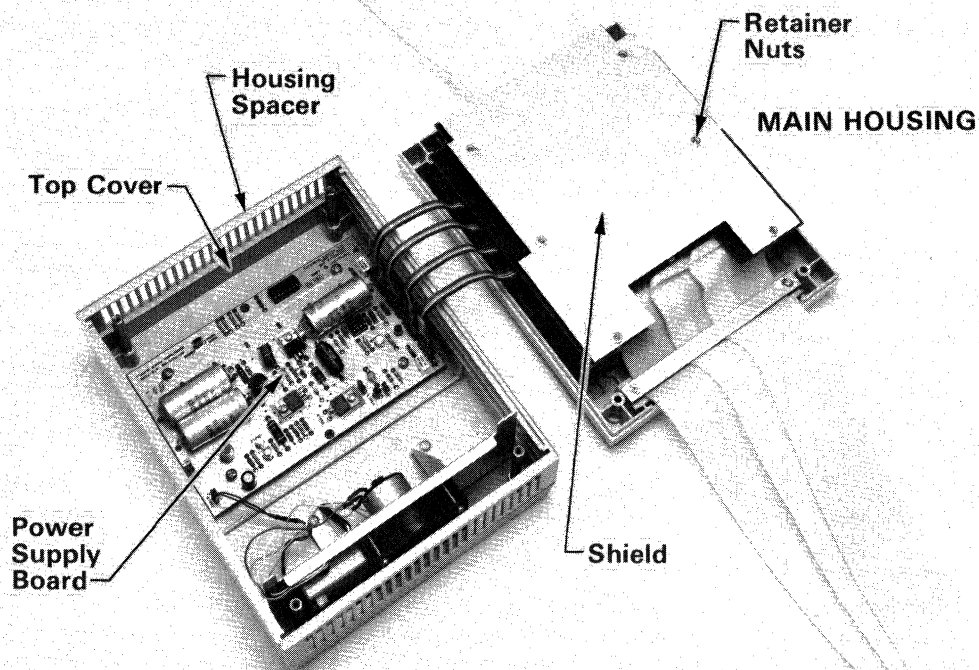
CAUTION

The Power Supply board is mounted to the top cover of the Interface Assembly. The power supply is connected to the main housing by four ribbon cables. Take care not to damage these cables when removing the top cover.

3. Remove the top cover of the Interface Assembly and set it beside the main housing (see Fig. 6-1).

NOTE

Do not disconnect any of the interconnecting ribbon cables.



3771-4

Fig. 6-1. Access to Power Supply board.

NOTE

For the remainder of this procedure, refer to Fig. 6-2.

4. Connect the negative (-) test probe of the DVM to GROUND (any one of the four Power Supply board mounting screws).
5. Connect the positive (+) test probe of the DVM to TP1061 on the Power Supply board (see Fig. 6-2).
6. Turn on the DVM and the microcomputer development system.

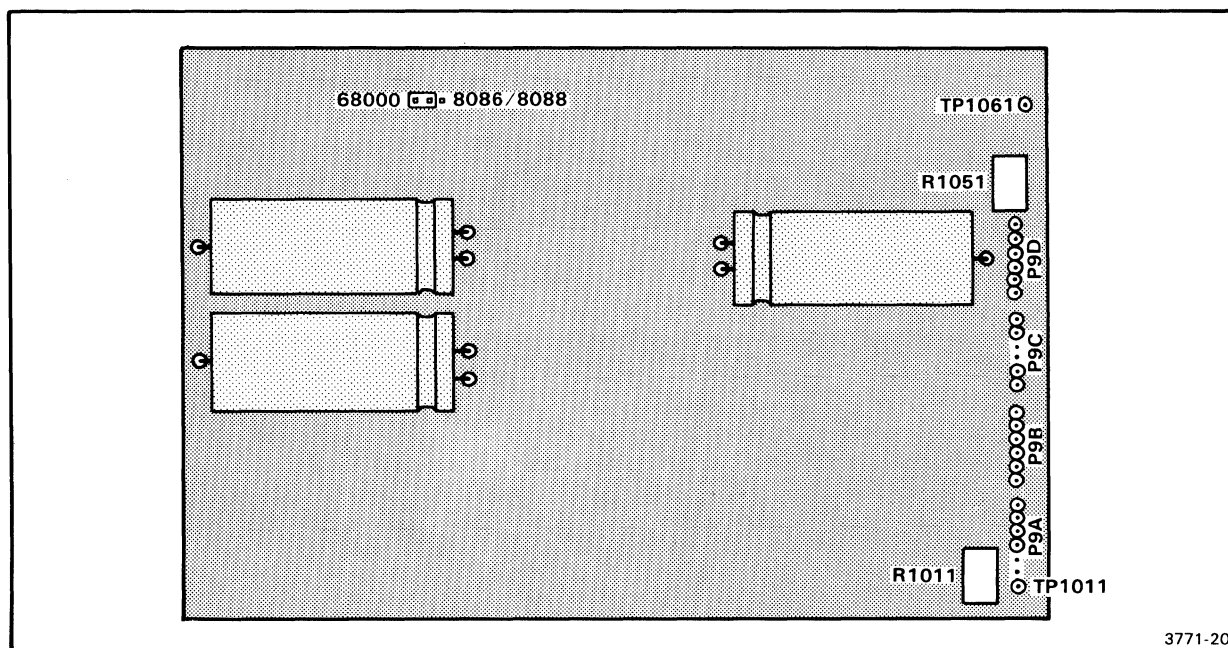


Fig. 6-2. Power Supply board.

7. At the system terminal, enter the following command:
 > SEL 68000
8. Observe the voltage measured by the DVM.
9. Adjust R1051 on the Power Supply board, until the DVM reads +4.92 Vdc, ± 20 mV (+4.9Vdc to +4.94Vdc).
10. Disconnect the positive (+) test probe of the DVM from TP1061.
11. Connect the positive (+) test probe of the DVM to TP1011 on the Power Supply board (see Fig. 6-2).
12. Observe the voltage measured by the DVM.
13. Adjust R1011 on the Power Supply board, until the DVM reads +5 Vdc, $\pm 5\%$ (+4.75Vdc to +5.25Vdc).
14. Turn off power to all equipment.
15. Disconnect the DVM from the Power Supply board.
16. Reassemble the Prototype Control Probe Interface Assembly in reverse order of disassembly.

Section 7

PERFORMANCE VERIFICATION

INTRODUCTION

You may occasionally want to verify timing relationships between the signals available at the pins of the Prototype Control Probe. The following paragraphs discuss equipment required to perform these timing verifications. Specifics of these timing relationships are provided in the 68000 Emulator Specifics section of your System Users Manual.

EMULATOR TIMING VERIFICATION

Verifying the timing relationships of emulator processor signals involves measurement of very small time increments. Test equipment used for these measurements should be able to resolve timing differences between two signals of 5 ns or less. A resolution of 1 ns is preferred for verification of the most critical timing.

Be careful that errors are not introduced by the test equipment being used. Test equipment calibration should be checked carefully. If you are using a dual trace oscilloscope, rather than a dual beam model, be sure to account for any possible skew between the two input channels. In general, good laboratory measurement practices should be followed to ensure accurate measurement of these timing relationships.

EQUIPMENT REQUIRED

The following equipment may be used to measure timing relationships with the preferred accuracy and resolution:

- TEKTRONIX 7844 Dual Beam Oscilloscope, or equivalent
- Two TEKTRONIX 7A26 Vertical Amplifiers, or equivalent
- TEKTRONIX 7B85 Delaying Time Base, or equivalent

CONTROLLING THE SIGNAL LINES UNDER TEST

Some processor signal lines, such as interrupt lines, are normally connected to asynchronous circuits. Timing relationships of these asynchronous signals may be difficult to measure with an oscilloscope. To exercise these signal lines in a periodic manner, you may find it necessary to develop software routines, or use an external test fixture such as the TEKTRONIX MicroLab I.

Section 8MAINTENANCE AND TROUBLESHOOTINGINTRODUCTION

This section describes preventive maintenance procedures that will help to improve equipment reliability. Techniques and aids for troubleshooting, including diagnostic testing routines, are also included in this section. If the equipment fails to operate properly, corrective measures should be taken immediately; an equipment malfunction may cause additional problems to develop.

STATIC-SENSITIVE PARTS

Many components can be damaged by static discharge. Static-caused damage may be catastrophic, or it may only cause degradation in component performance. Either type of damage is costly: destroyed devices must be replaced, and unnoticed marginal devices can cause intermittent equipment malfunction.

To minimize static problems during maintenance or troubleshooting, follow these procedures:

1. Minimize the handling of static-sensitive parts.
2. Transport and store static-sensitive parts in their original containers, on a metal rail, or on conductive foam. Label any container having a static-sensitive assembly or device.
3. Before handling static-sensitive parts, discharge the static charge on yourself by using a grounded metal wrist strap. Static-sensitive assemblies or devices should be serviced only at a static-free work station, and only by qualified personnel.
4. Do not allow anything capable of generating or holding a static charge onto the work station surface.
5. Pick up a part by the body, never by the leads.
6. Keep the device leads shorted together whenever possible.
7. Do not subject a device to sliding movements over any surface.
8. Avoid handling parts in areas having a floor or work surface covering that contributes to the generation of a static charge.

9. Use a soldering iron that has a connection to earth ground.
10. For desoldering, use a special anti-static suction-type tool, such as the Silverstat Soldapullit, or a wick-type desoldering tool.

REDUCING SUSCEPTIBILITY TO STATIC DISCHARGE

This equipment and its supporting system incorporate a number of safeguards to reduce the chance of static discharge damage.

CAUTION

Violation or modification of the following safeguards can result in ground loops and/or static discharge problems.

1. The ground (earth) wire of the primary power cable is connected to the chassis where the cable enters the unit.
2. Shields of interconnecting cables are grounded to the chassis at the point of connection to each unit.
3. Ground loops have been avoided by installing a common ground between all units.

PREVENTIVE MAINTENANCE

Preventive maintenance consists of cleaning, visual inspection, and performance checks. The preventive maintenance schedule established for the equipment should be based on the amount of use, and on the environment in which the equipment is operated.

CLEANING

Clean the equipment often enough to prevent dust or dirt from accumulating in or on it. Dirt acts as a thermal insulator and prevents efficient heat dissipation. It also provides high-resistance electrical leakage paths between conductors or components in a humid environment.

CAUTION

Do not allow water to get inside any enclosed assembly or components, such as switch assemblies, potentiometers, etc. Do not clean any plastic materials with organic cleaning solvents (such as benzene, toluene, xylene, acetone, or similar compounds); such solvents may damage the plastic.

Exterior

Clean dust from the outside of the equipment by cleaning the surface with a soft cloth or brush. The brush will remove dust from around the front panel controls. Hardened dirt may be removed with a cloth dampened in water that contains a mild detergent. Abrasive cleaners should not be used.

Interior

Clean the interior by loosening accumulated dust with a soft, dry brush, then blow the loosened dirt away with low-pressure air. To clean a circuit board, remove the circuit board and clean it with a soft, dry brush. Hardened dirt or grease may be removed with a cotton-tipped applicator dampened with a solution of mild detergent and water. Abrasive cleaners should not be used.

After cleaning, allow the interior to dry thoroughly before applying power to the equipment.

VISUAL INSPECTION

After cleaning, carefully check the equipment for such defects as poor connections and damaged parts. For most visible defects, the remedy is obvious. If heat-damaged parts are discovered, try to determine the cause of overheating before replacing the damaged part; otherwise, the damage may be repeated.

SERVICING AIDS

DIAGRAMS

Circuit diagrams appear on foldout pages in the Diagrams section of the manual. The circuit number and electrical value of each component are shown on the diagram. (See the first tab page for an explanation of the symbols used to identify components in each circuit.) Components on circuit boards are assigned vertical and horizontal grid numbers, which correspond to the location of the component on the circuit board. Refer to the Replaceable Electrical Parts section for a complete description of each component and

assembly. Those portions of the circuit that are on circuit boards are enclosed with a black border line, with the name and assembly number shown on the border.

CIRCUIT BOARD ILLUSTRATIONS

Electrical components, connectors, and test points are identified on circuit board illustrations located on the inside fold of the corresponding circuit diagram, or on the back of the preceding diagram. This allows cross-referencing between the diagram and the circuit board, and shows the physical location of components.

CAPACITOR MARKING

The capacitance (in microfarads or picofarads) and voltage ratings of many ceramic, mica, plastic film, and electrolytic capacitors are marked on the component body. The values of other ceramic disc and plastic film capacitors, as well as monolithic ceramic capacitors (such as DIP and glass encapsulated types), are marked according to the code shown in Fig. 8-1. Tantalum capacitors are marked in microfarads or according to the color code shown in Fig. 8-2.

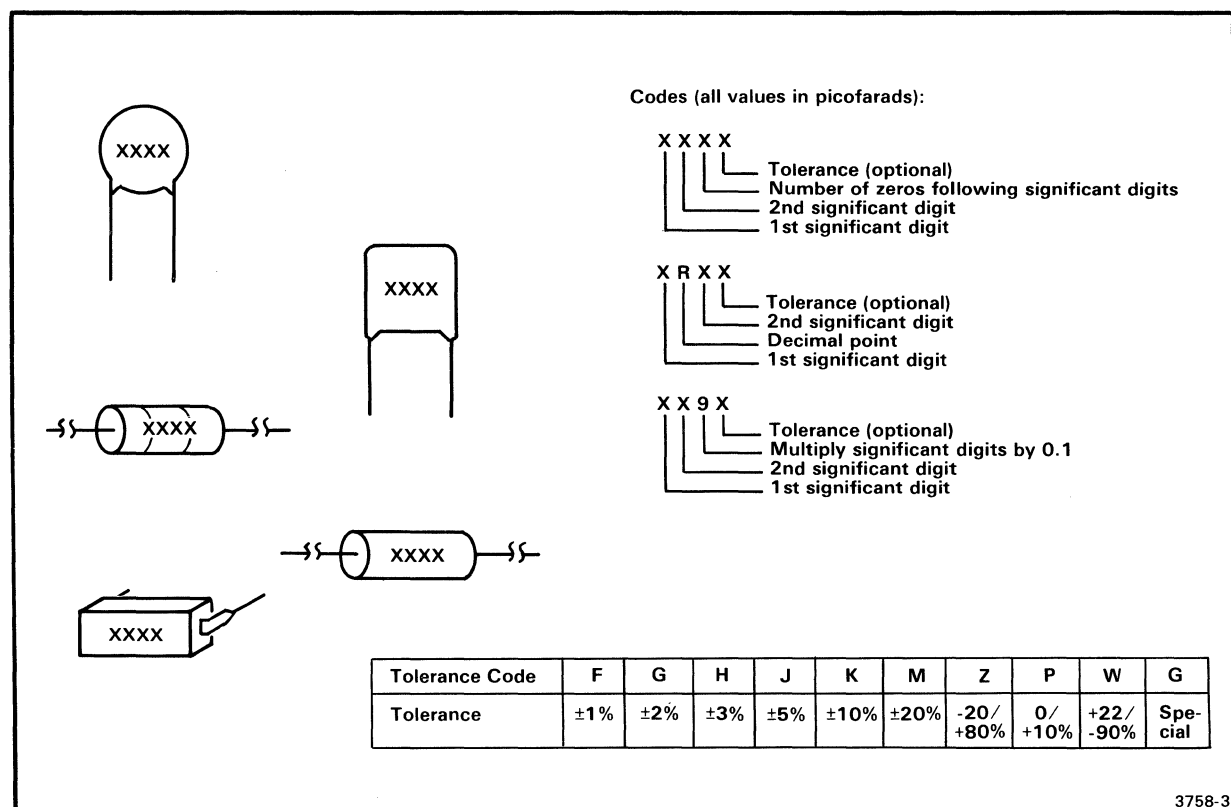


Fig. 8-1. Ceramic and film capacitor code.

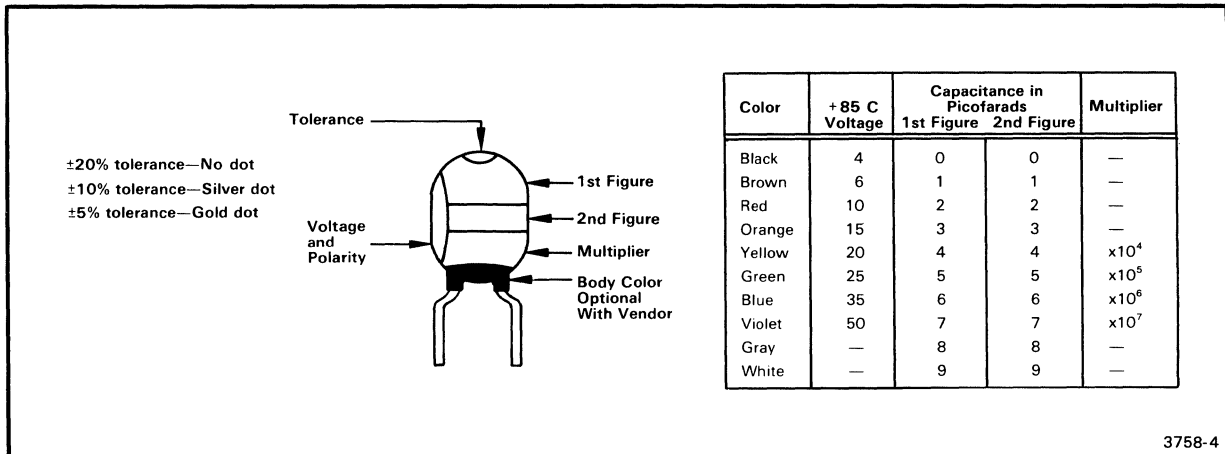


Fig. 8-2. Tantalum capacitor color code.

RESISTOR MARKING

Carbon resistors are marked according to the standard 4-band resistor color code. The fifth band, if present, indicates the device's failure rate. Metal film resistors are marked according to either the standard 4-band resistor color code or to the 5-band color code shown in Fig. 8-3.

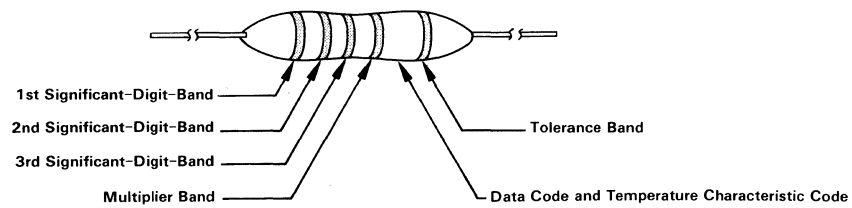
DIODE CODE

Diode cathodes are marked by a stripe, a series of stripes, or a dot on the diode body. Some diodes have a diode symbol printed on one side. Figure X-4 illustrates some common diode types and polarity markings.

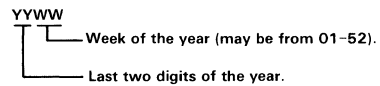
COIL AND TRANSFORMER IDENTIFICATION

Coils and transformers used in this product are identified by Tektronix part numbers. If the number appearing on the part consists of only four digits, a prefix number must be added to obtain the complete part number:

Classification	Part No. Prefix
Fixed coils	108-
Variable coils	114-
Transformers	120-

COLOR BAND INFORMATION

Color	1st Sig. Digit	2nd Sig. Digit	3rd Sig. Digit	Multiplier	Tolerance ± %
Black	0	0	0	1	—
Brown	1	1	1	10	1. F
Red	2	2	2	100	2. G
Orange	3	3	3	1,000	3. H
Yellow	4	4	4	10,000	—
Green	5	5	5	100,000	.5 D
Blue	6	6	6	1,000,000	.25 C
Violet	7	7	7	10,000,000	.1 B
Grey	8	8	8	100,000,000	.05 A
White	9	9	9	1,000,000,000	—
Gold				.1	5. J
Silver				.01	10. K
No Color					15. L
No Color					20. M

DATA CODE INFORMATIONTEMPERATURE CHARACTERISTIC INFORMATION

Temperature Characteristic Code	Temperature Coefficient (PPM/°C)	Temperature Range (°C)
T-0 D (C-0)	0 to ±150	-55 to +175
T-00	0 to ±200	-55 to +175
T-1 D (C-1)	0 to ±100	-55 to +175
T-2 C (C-2)	0 to ± 50	-55 to +175
T-9 E (C-3)	0 to ± 25	-55 to +175
T-10	0 to ± 15	-20 to + 85
T-13	0 to ± 10	-20 to + 85
T-14	0 to ± 20	-20 to + 85
T-15	0 to ± 25	-20 to + 85
T-16	0 to ± 5	-20 to + 85
T-18	0 to ± 2	0 to + 60
T-18	0 to ± 5	-55 to +125
T-B	0 to ± 10	25 to +125
T-E	0 to +100 -500	-55 to +175
T-R	0 to +100 -250	-55 to +175

3758-5

Fig. 8-3. Metal film resistor color code.

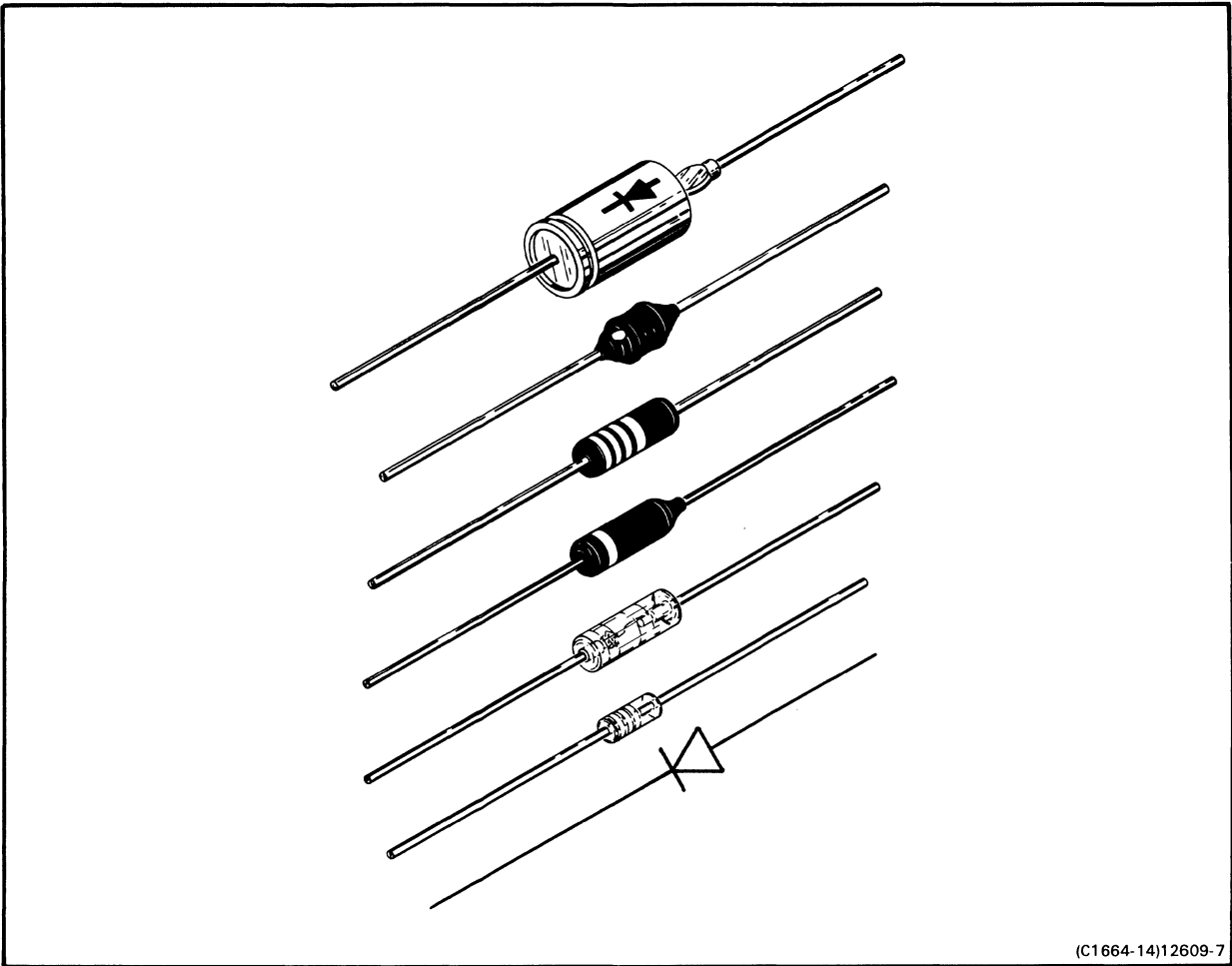


Fig. 8-4. Diode polarity markings.

TRANSISTOR AND INTEGRATED CIRCUIT PIN CONFIGURATION

Lead identification drawings for transistors and 3-lead integrated circuits are included with the schematic diagrams. Pin 1 identification for typical DIP integrated circuits is illustrated in Fig. 8-5.

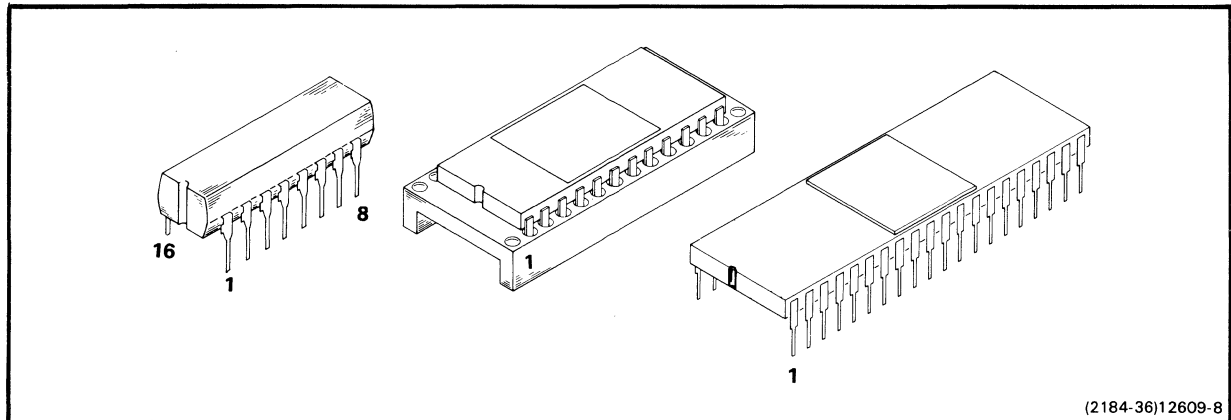


Fig. 8-5. Integrated circuit pin 1 identification.

OBTAINING REPLACEMENT PARTS

Most electrical and mechanical parts are available through your local Tektronix Field Office or representative. The Replaceable Electrical and Mechanical Parts sections contain information on how to order these replacement parts. Many standard electronic components can be obtained locally in less time than required to order from Tektronix, Inc. It is best to duplicate the original component as closely as possible. Parts orientation and lead dress should be duplicated, since orientation may affect circuit interaction.

If a component you have ordered has been replaced with a new or improved part, your local Field Office or representative will contact you concerning the change in the part number.

ASSEMBLY REPAIR AND EXCHANGE PROGRAM

Tektronix service centers provide replacement or repair of TEKTRONIX equipment and major assemblies. Contact your local service center for this service.

Prototype Control Probe Assembly/Disassembly

Some configuration options are selected by positioning jumper blocks in the Prototype Control Probe's Interface Assembly. The jumpers are located on the Control, Buffer, and Mobile Microprocessor boards. To gain access to these boards, perform the following procedure:

1. Ensure that primary power (115 Vdc or 230 Vac) to the microcomputer development system is OFF.
2. Remove the four screws at the corners on the bottom of the Interface Assembly housing.

CAUTION

The Power Supply board is mounted to the top cover of the Interface Assembly. The Power Supply board is connected to the main housing by four ribbon cables. Take care not to damage these cables when removing the top cover and housing spacer.

3. Remove the top cover of the Interface Assembly and set it beside the main housing (see Fig. 8-6).

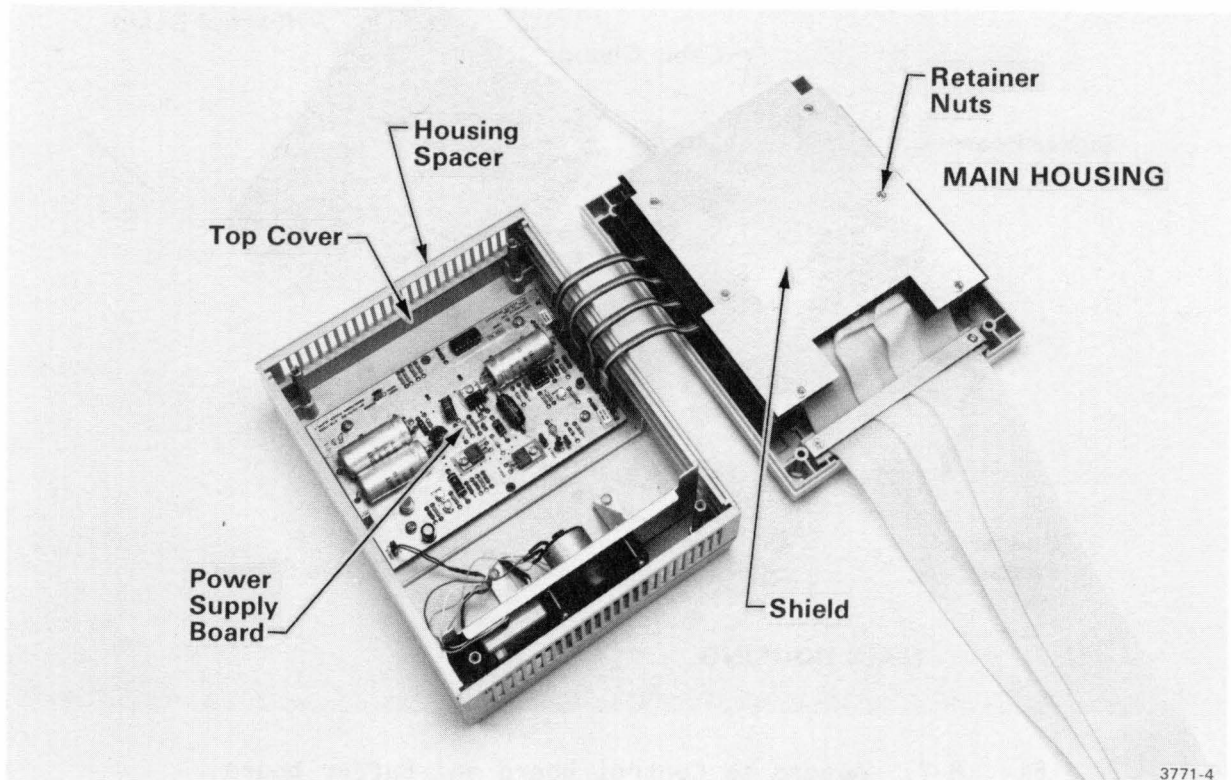


Fig. 8-6. Access to Power Supply board.

4. Lift the housing spacer and rotate it to set on the top cover (see Fig. 8-6).
5. Disconnect the four ribbon cables (J1010, J1020, J1030, and J1040) from the Power Supply board. Then set the top cover and housing spacer aside.
6. Remove the six retaining nuts from the metal shield on top of the main housing. Then remove the shield by lifting straight up, and set it aside.
7. Lift the Control board away from the main housing and drape it to one side, as shown in Fig. 8-7. Take care not to damage the interconnecting ribbon cable.

NOTE

Now you may select configuration jumpers on either the Buffer board or the Control board. Refer to the Configuration Jumpers discussed in Section 3, for more specific information.

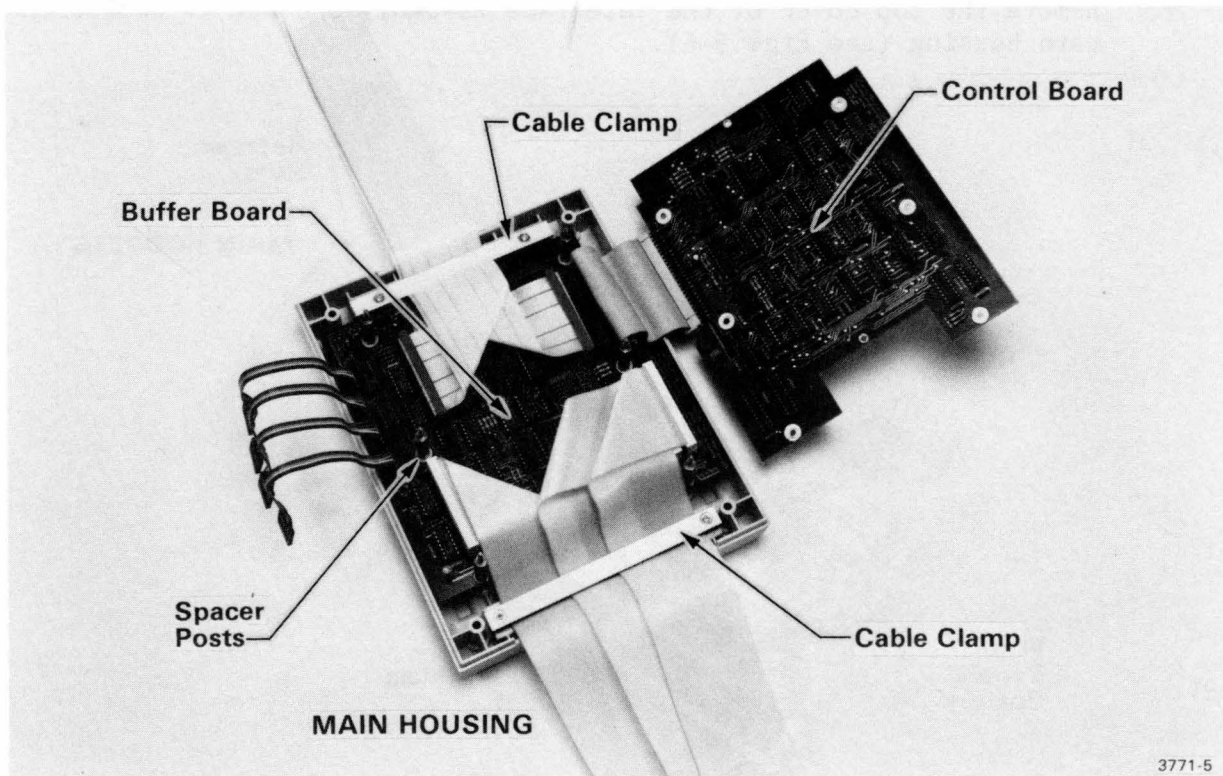


Fig. 8-7. Access to Control board and Buffer board.

8. Remove the six spacer posts. Note that the shorter threads are used to retain the Buffer board in place.

9. Remove the two cable clamps located at each end of the main housing.
10. Lift the Buffer board and turn it over to expose the Mobile Microprocessor board (refer to Fig. 8-8).

NOTE

Now you may select configuration jumpers on the Mobile Microprocessor board. Refer to the Configuration Jumpers discussed in Section 3, for more specific information.

11. After you have selected the configuration jumpers, reassemble the Interface Assembly in reverse order of disassembly.

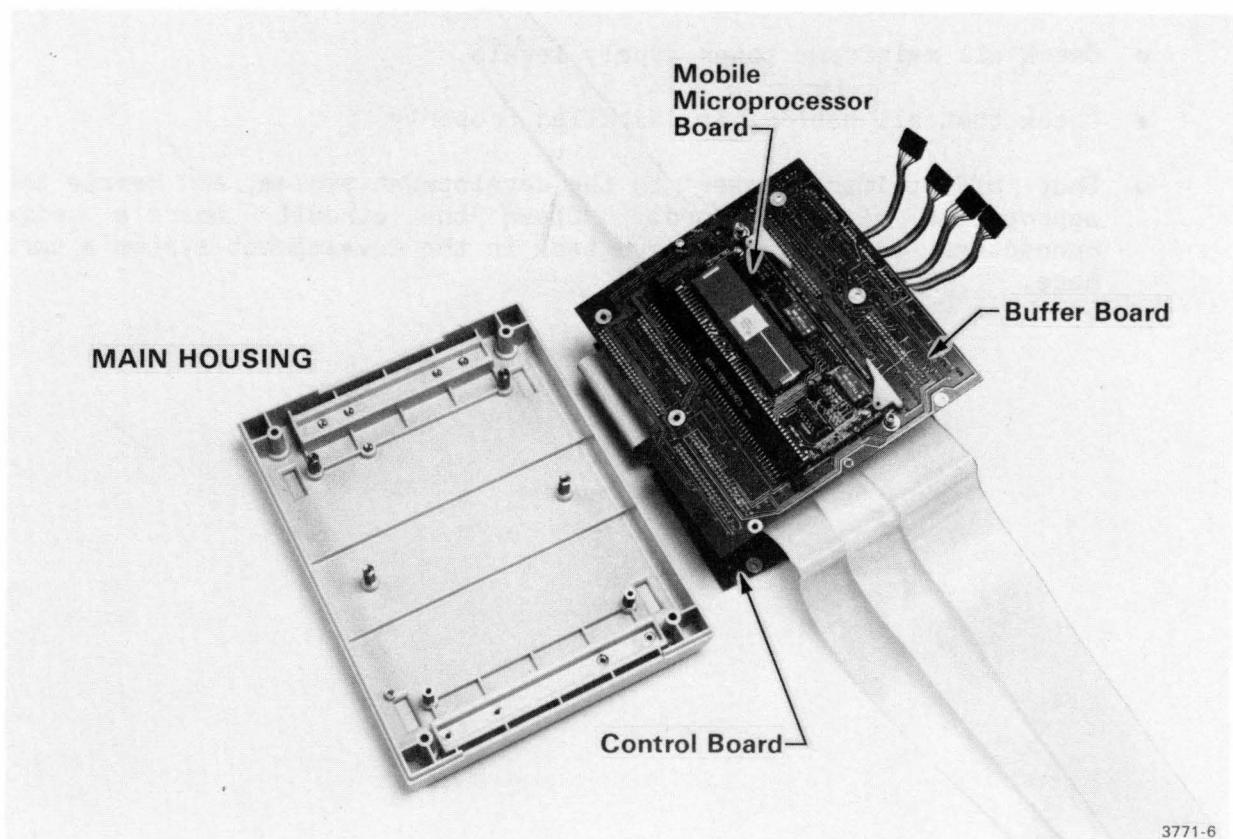


Fig. 8-8. Access to Mobile Microprocessor board.

TROUBLESHOOTING

Before beginning any troubleshooting work, check your warranty or service agreement. For your warranty to remain in effect, all service must be performed by Tektronix, Inc. for the first 90 days following delivery.

Your Tektronix Service Support Center is best suited to perform repairs on this unit. However, the following general troubleshooting procedures may aid you in tracing a problem to its source.

INITIAL EQUIPMENT CHECKS

Before you start any detailed troubleshooting of the equipment, perform the following basic equipment checks:

- Verify that all system equipment is operating correctly.
- Check all mainframe power supply levels.
- Check that all cabling is installed properly.
- Shut off primary power to the development system, and remove the appropriate circuit boards. Clean the circuit board's edge connectors and put the board back in the development system's card cage.

Section 9

INSTALLATION PROCEDURES

INTRODUCTION

This section tells how to install the 68000 Emulator Processor and its Prototype Control Probe in your TEKTRONIX microcomputer development system. This section also contains information for connecting the 64-pin probe plug to your prototype circuit.

CAUTION

Before inserting or removing any module, ensure that primary power to the microcomputer development system is OFF. Inserting or removing a module (or board) while the power is ON may result in component damage.

CAUTION

Under no circumstances can any other Emulator Processor module be installed in any TEKTRONIX microcomputer development system while the 68000 Emulator Processor module is installed. Excessive power supply loading will result.

INSTALLING THE EMULATOR PROCESSOR AND PROTOTYPE CONTROL PROBE

The 68000 Prototype Control Probe, with its Cable Termination board, is attached to EMU 1 of the 68000 Emulator Processor module. The 68000 Emulator Processor module, with the Prototype Control Probe attached, is then installed in your development system. To install the 68000 Emulator Processor module, perform the following procedure:

1. Verify that primary power (115 Vac or 230 Vac) to the microcomputer development system is OFF.
2. Remove the cover retainers at the upper corners on the rear of the mainframe (Fig. 9-1).

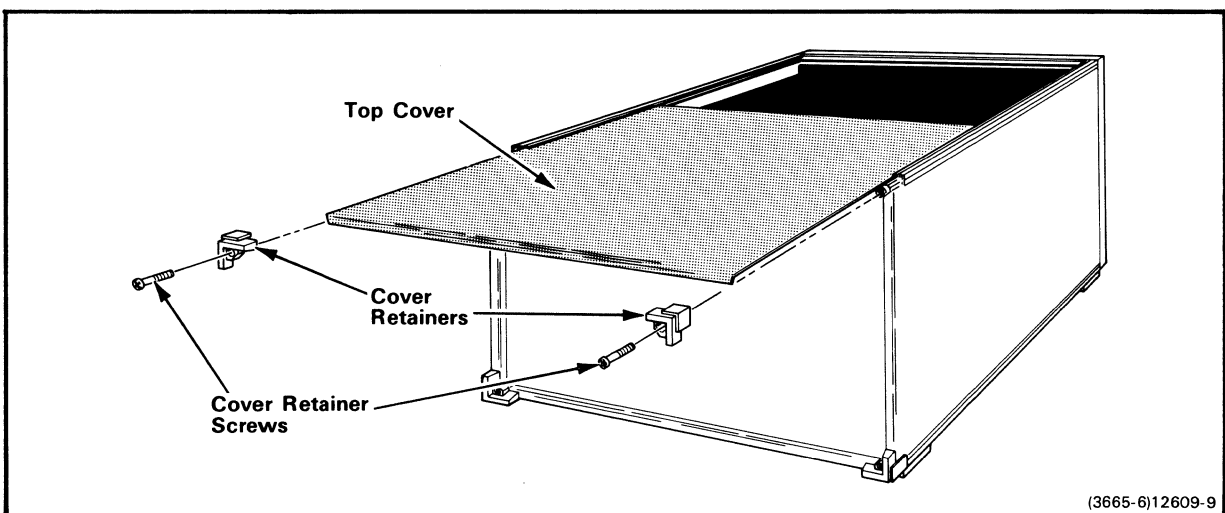
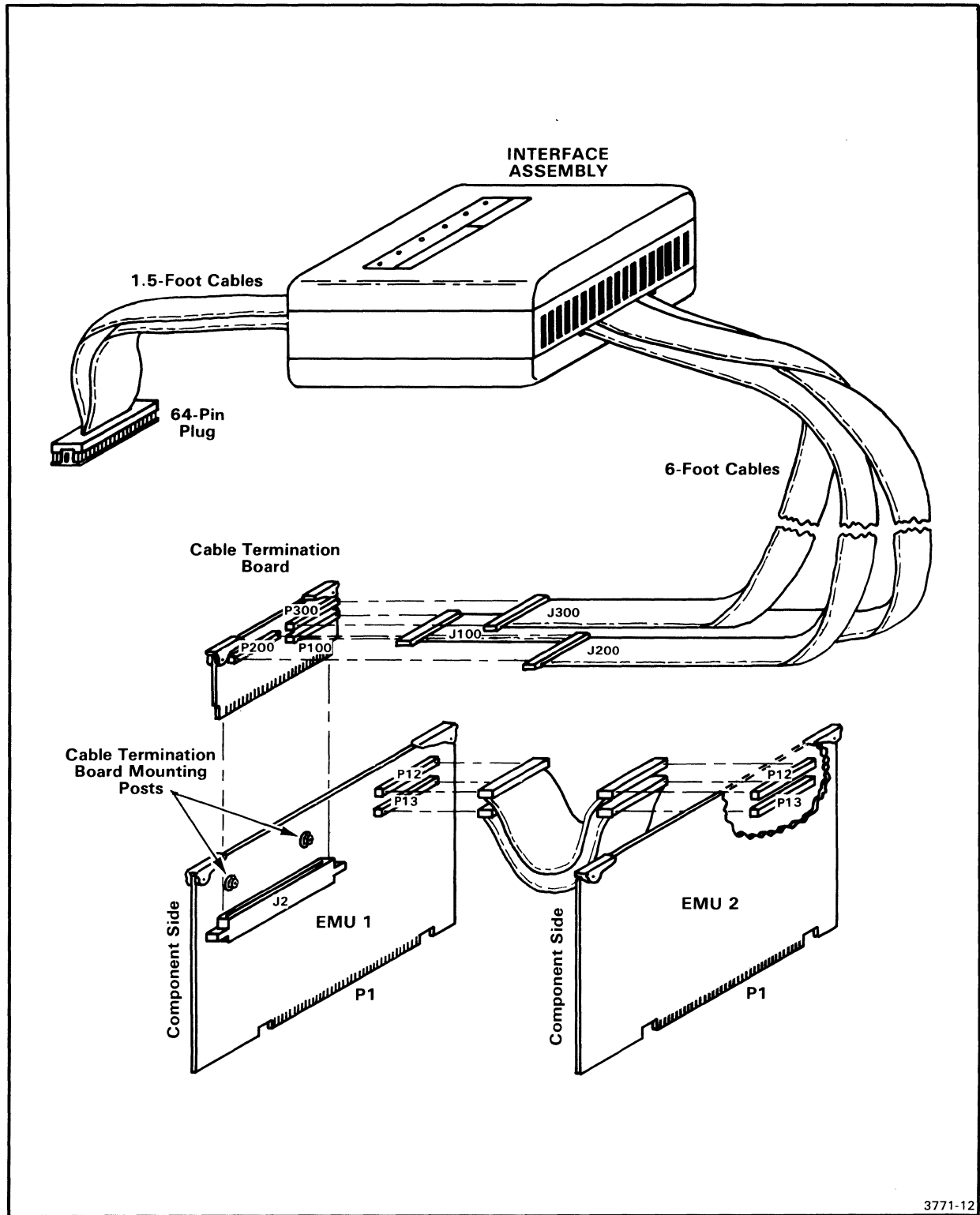


Fig. 9-1. Removal/installation of top cover.

3. Remove the top cover by sliding it straight back, then set it aside.
4. Remove the two retaining screws from the Cable Termination board mounting posts located on EMU 1 (see Fig. 9-2).
5. Hold the Cable Termination board above J2 on EMU 1. Make sure the component side of the Cable Termination board faces away from EMU 1.



3771-12

Fig. 9-2. 68000 Emulator Processor with Prototype Control Probe.

6. Guide edge connector P2 of the Cable Termination board into socket J2 on EMU 1.
7. Install the two retaining screws, removed in step 4, at the upper corners of the Cable Termination board. Tighten the screws securely.
8. Connect EMU 1 (with Cable Termination board) to EMU 2, using the two short ribbon cables provided. Dress the cables as illustrated in Fig. 9-3.

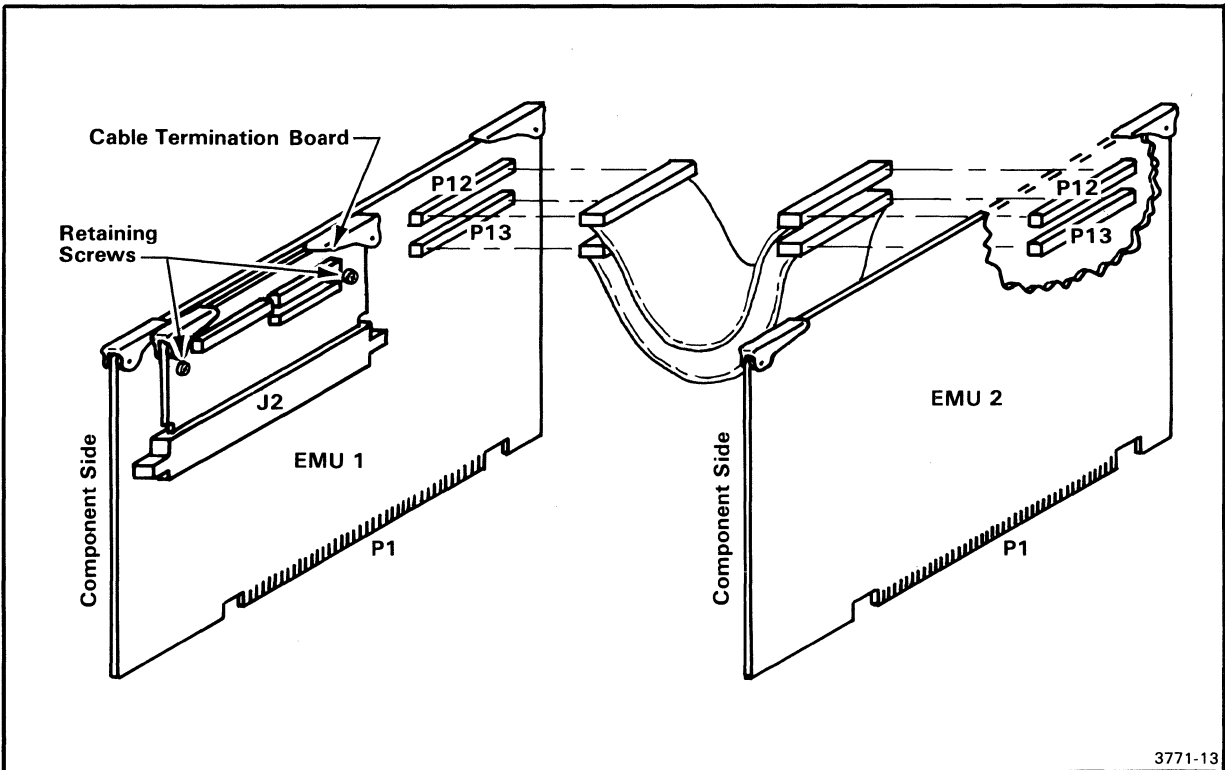


Fig. 9-3. EMU 1/EMU 2 interconnection with Cable Termination board.

9. Facing the front of the mainframe, hold EMU 1 and EMU 2 by their upper edges. With the component sides facing left, align the boards with other modules in the mainframe.

10. Guide EMU 1 and EMU 2 down the vertical channels to J15 and J16, respectively, on the Main Interconnect board (refer to Fig. 9-4).

NOTE

When EMU 1 and EMU 2 reach their connectors on the Main Interconnect board, do not snap them into place yet. You may need to lift the boards slightly when performing later steps in this procedure.

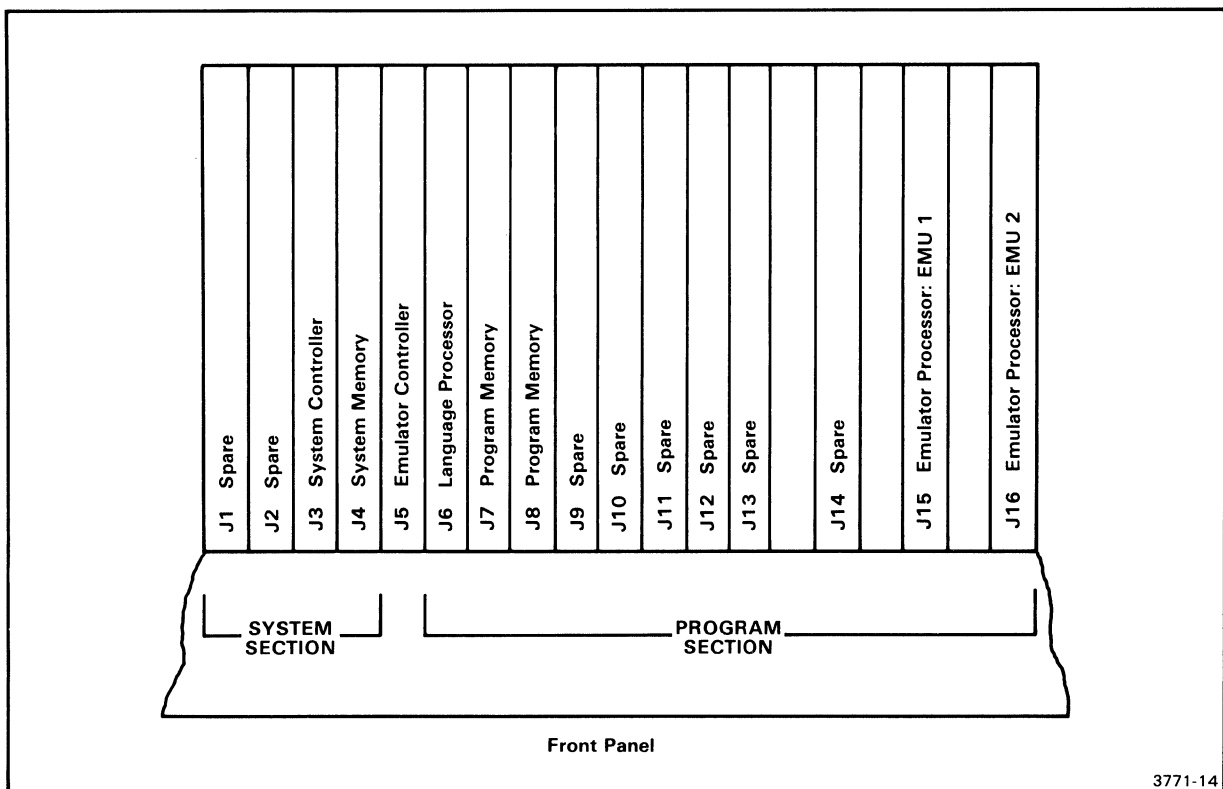


Fig. 9-4. Recommended module arrangement.

11. Remove the two mounting screws at the top and bottom of the strain relief plate, as shown in Fig. 9-5. Then remove the strain relief/cable clamp assembly from the rear panel.

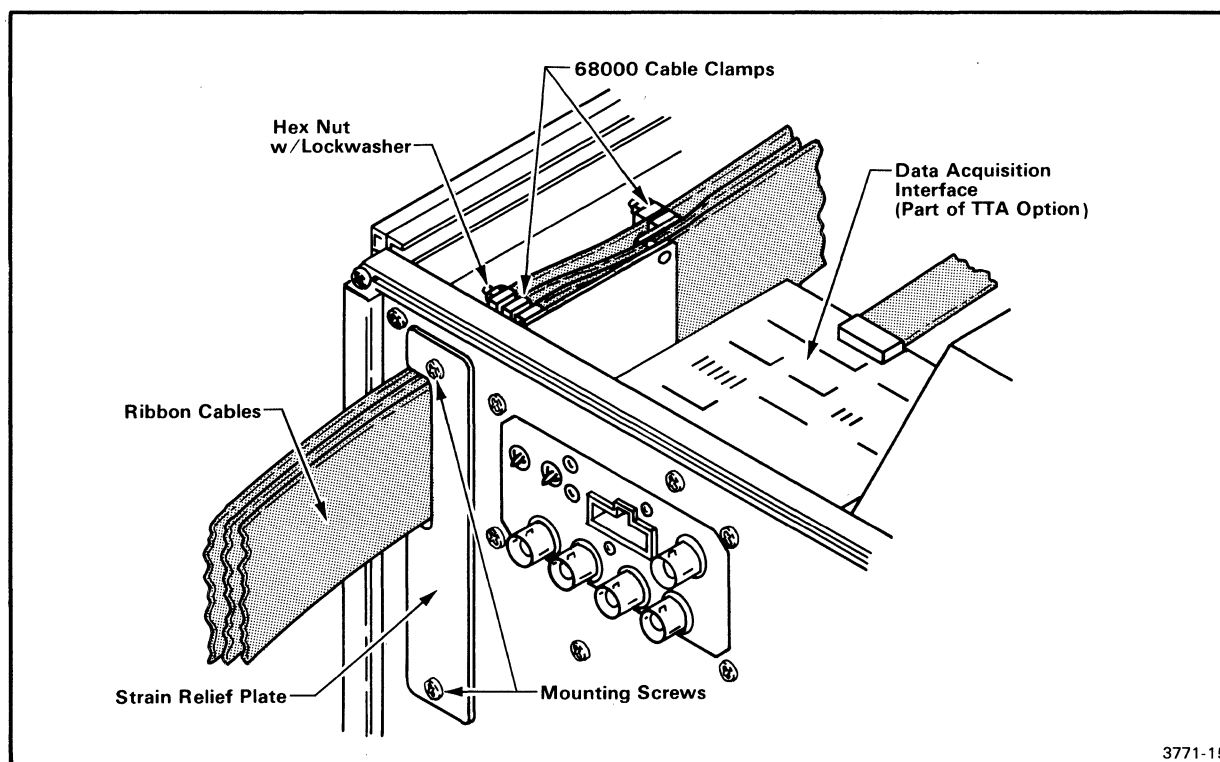


Fig. 9-5. Strain relief plate installation/removal.

NOTE

The standard cable clamps provided with your development system are not compatible with the ribbon cables used with the 68000 Prototype Control Probe. The standard clamps must be replaced with the clamps provided with your 68000 Prototype Control Probe.

12. Ensure that you have allowed enough ribbon cable to reach the Cable Termination board (already attached to EMU 1), which is now located in the development system's card cage. Then mount the long Prototype Control Probe ribbon cables to the cable clamp assembly, using the new clamps provided. Secure the cable clamps with hex nuts and lock washers. Refer to Fig. 9-6.

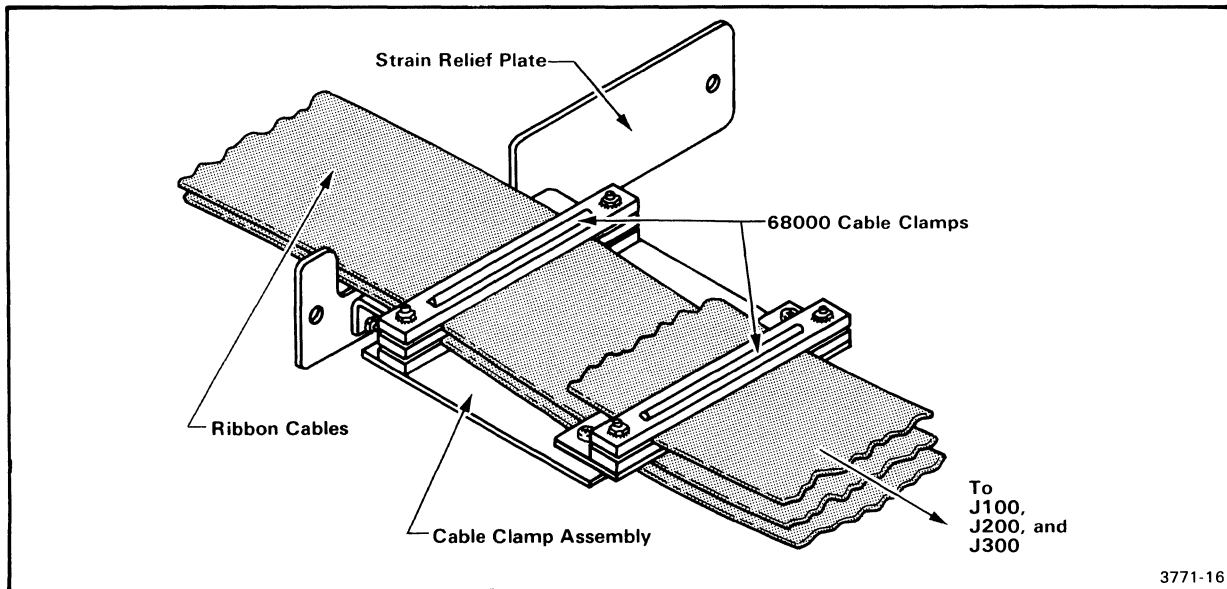


Fig. 9-6. Ribbon cable installation.

13. Feed the Prototype Control Probe connectors (J100, J200, and J300) through the cableway opening. Then guide the strain relief/cable clamp assembly into the cableway opening. Attach the strain relief plate to the rear panel, using the two screws removed in step 11.
14. Attach the ribbon cable connector labeled J300 to P300 (refer back to Fig. 9-2). Be sure that pin 1 of the cable connector (blue stripe) and pin 1 of the module socket align and are to the left when viewed from the component side of the module.
15. Following the procedure of step 14, attach ribbon cable connector J200 to P200 on the Cable Termination board.
16. Following the procedure of step 14 again, attach ribbon cable connector J100 to P100 on the Cable Termination board.
17. Now slide EMU 1 and EMU 2 down until they reach their respective connectors on the Main Interconnect board in your development system's mainframe. Then press down firmly and evenly on the top edges (one board at a time), until each board snaps into place.
18. Dress the cables along the cableway at the side of the mainframe and over the side of the card cage. Make sure the cables are dressed to lie flat, to allow clearance for the top cover.
19. Slide the top cover back into the guide tracks at the top of the mainframe. Be sure the cover is properly seated in the slot at the front of the mainframe.

20. Install the cover retainers at the upper corners on the rear of the mainframe (see Fig. 9-1). Tighten the cover retainer screws securely.

CONNECTING TO THE PROTOTYPE

The 64-pin plug at the end of the 1.5-foot ribbon cables fits into the 68000 microprocessor socket on the prototype. Pin 1 on the plug must be mated with receptacle 1 on the socket. A notch is located near pin 1 on both the protective spring-loaded plate and the body of the plug, to aid in pin identification (see Fig. 9-7).

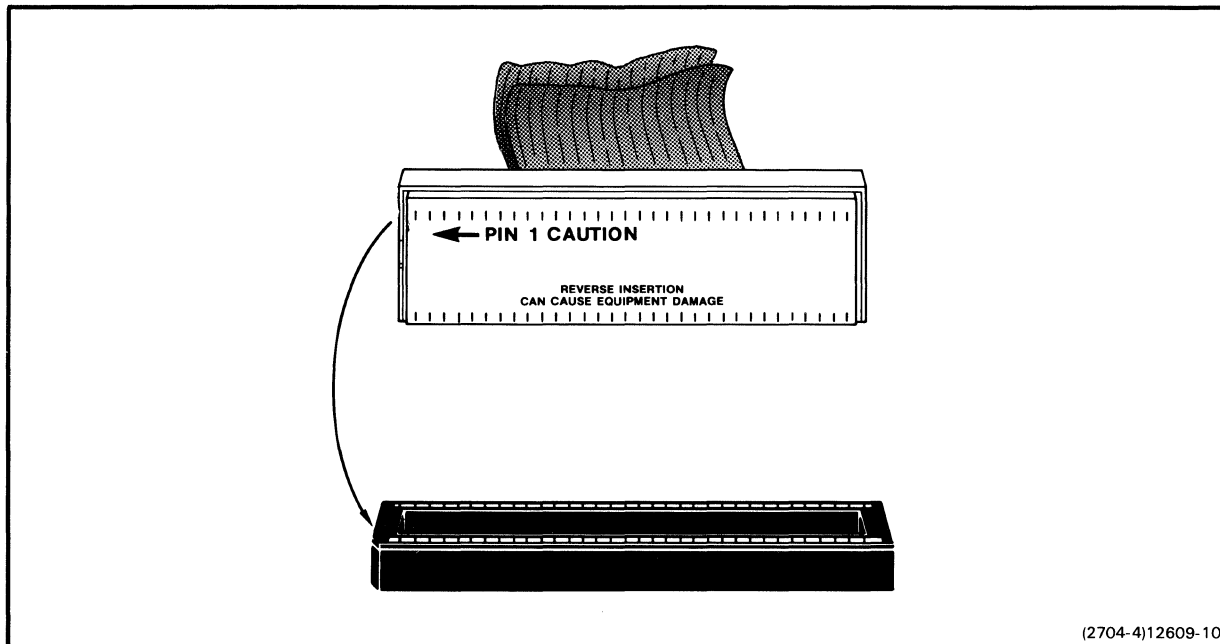


Fig. 9-7. Pin identification and proper plug insertion.

CAUTION

If the Prototype Control Probe plug is incorrectly inserted in the prototype socket, damage to the Prototype Control Probe will result. Figure 9-7 shows the proper method of plug insertion.

If you are using a zero-insertion-force (ZIF) socket for the 68000 microprocessor on your prototype, you should insert a standard low-profile 64-pin DIP socket between the probe plug and the prototype's ZIF socket, to ensure a secure mechanical and electrical connection (see Fig. 9-8).

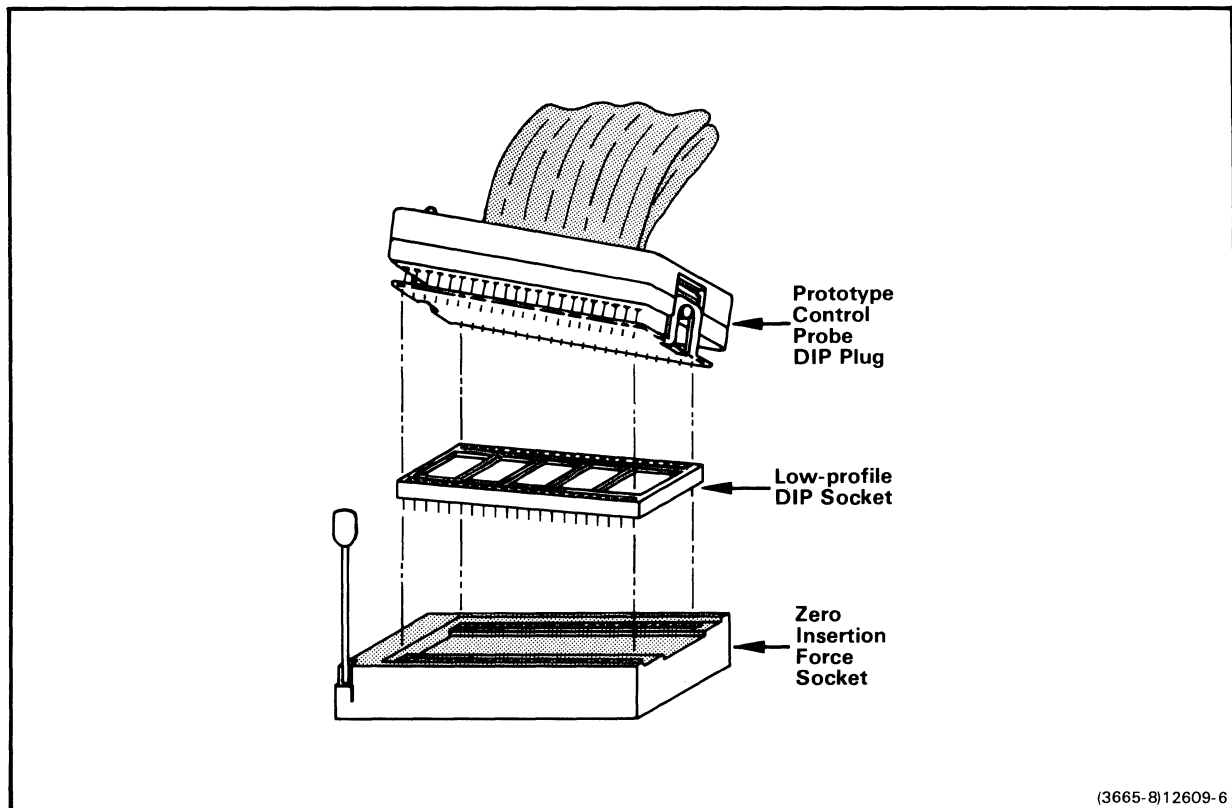


Fig. 9-8. Using a zero-insertion-force socket.

GROUNDING

A proper ground system is mandatory for satisfactory operation of your microcomputer development system. The 68000 Emulator Processor module and its Prototype Control Probe, as well as any other optional and peripheral equipment, must be properly grounded to eliminate ground loops and to reduce susceptibility to static discharge. The following grounding procedures are recommended:

- Ensure that primary power cords of all units (including your prototype system) are connected to outlets that are on the same ground system.
- Attach all grounding strap lugs to the chassis of any unit being grounded. Ensure that the lugs make good contact with bare metal; remove any paint or protective coating from the metal before attaching the ground lug.

Section 10TECHNICAL REFERENCE MATERIALI/O PORT CONFIGURATIONS

This is a summary of the signals into and out of the 68000 Emulator Processor. Descriptions of the interface to the development system bus and the interface of the top plane connections to the Trigger Trace Analyzer (TTA) and Memory Allocation Controller (MAC) are provided here. The summary consists of a short description of the signal's function.

MAIN INTERCONNECT BUS

These are the lines designated as the development system bus on the program side of the mainframe.

Table 10-1
Main Interconnect Bus

Line	Mnemonic	Description
1--4	+5Vdc	Primary TTL power supply
5--8	AUX BUS	(not used)
9-10	GND	Ground
11-12	+12Vdc	+12 volt power supply
13-14	-12Vdc	-12 volt power supply
15-16	GND	Ground
17-32	A0(L)-A15(L)	Address line
33	CMEM (H)	Bank switch command. When high (H), allows the 2650 to address the 68000 Emulator Processor RAM.

Table 10-1 (cont)

Line	Mnemonic	Description
34	RAM INH(L)	Asserted by 68000 Emulator Processor whenever on board RAM is accessed or when mapped to the user prototype during emulation.
35	WD ACCESS(L)	Indicates whether a memory access by the 68000 Emulator Processor is a byte or word operation.
36-51	D0(L)-D15(L)	Data lines.
52	M(L)/IO(H)	Indicates whether the 68000 Emulator Processor is executing an SVC(L). The development system bus sees "IO(L)" indication if and only if the 68000 Emulator Processor is executing an SVC.
53	WRP(L)	Write pulse. Data valid on trailing edge.
54	OPREQ(L)	Indicates memory access. (Bus operation in progress.)
55	R(H)/W(L)	Indicates read/write operation.
56	GND	Ground
57	JMP CMD(L)	Serves no function on 68000 Emulator Processor, although it is acknowledged in order to clear the Emulator Controller board.
58	RUN(L)	Indicates that the Emulator Processor is running and has the bus.
59	RESET(L)	Initializes the 8301 and deactivates the Emulator Processor. This latches the 68000 microprocessor into its "reset" state.

Table 10-1 (cont)

Line	Mnemonic	Description
60	JMP ACK(L)	Issued in response to JMP CMD(L). This is to clear the Emulator Controller board. The JMP CMD/JMP ACK sequence has no effect in the Emulator Processor.
61	SLV INTACK(L)	(not used)
62	SLV INT(L)	(not used)
63-70	A16(L)-A23(L)	Address lines, to the 8301's program section.
71	DBG INT 29(L)	Causes the Emulator Processor to halt. (This is from the TTA.)
72	DBG INT 30(L)	(not used)
73	DBG INT(L)	(not used)
74	UPSE(L)	(not used)
75	SLV OPREQ(L)	Indicates traceable Emulator Processor cycle. (Used by the TTA and Emulator Controller.)
76	SLV RESET(L)	(not used) -- Emulator Processor is reset via its I/O port or by line 59 (RESET(L)).
77	SLV PSE(L)	Causes Emulator Processor to halt.
78	RFSH NW(L)	(not used)
79	SLV INOP(L)	(not used)
80	SWAP(L)	Asserted when byte data is required on D8(L)-D15(L). This byte operation occurs when A0(L) is high.
81	spare	
82	FETCH(L)	Not used. Pulled up w/ 4.7K resistor. Debug functions requiring "Fetch" are not used by the 68000 Emulator Processor.

Table 10-1 (cont)

Line	Mnemonic	Description
83	PAUSE(L)	(not used)
84	MSTR RUN(L)	Indicates that the system processor in the System Controller is running.
85	GND	Ground
86	BYTE ADDR(L)	Shifts address lines down one bit on the memory board. Pulled low while the Emulator Processor is running.
87	F.P.HOLD(L)	Waits the Emulator Processor if enabled by jumpers J1045 and J2045.
88	MSTR INTACK(L)	(not used)
89	MSTR INT 3(L)	(not used)
90	UMAP(L)	(not used) - UMAP signal is generated internally on the Emulator Processor.
91	EMUVEN(L)	(not used)
92	SELF TEST(L)	(not used)
93	SLV CLK(L)	Emulator Processor clock. Generated when Emulator Processor is running (8MHz max).
94	I/O CLK(L)	(not used)
95	2650 CLK	(not used)
96	SYS CLK	Used as 10MHz clock for emulator control circuitry clock.
97-100	GND	Ground

TOP PLANE CONNECTOR P6

The top interconnect bus connects the 68000 Emulator Processor, the memory controller, and the TTA together to form the TOP PLANE.

Table 10-2
Top Plane Connections for P6

Line	Mnemonic	Description
1	TA24 (MAC)	Address space encoding - FC1
2	TA25 (MAC)	Address space encoding - FC1
3	DYM WAIT(L)	(not used)
4	spare	
5	MEM RELOC(L)	Signal indicates MAC board is installed. Effect on Emulator Processor is to disable (tri-state) A12(L)-A23(L) on main interconnect.
6	GND	Ground
7	RUN MODE(L)	Indication to TTA that the 68000 microprocessor is running user code and should be traced. Jumperable to trace PROM routines.
8	GND	Ground
9	TOP SLVOP(L)	Indicates traceable user program bus cycle.
10	GND	Ground
11	TOP CONSEC(L)	(not used)
12	GND	Ground
13	TOP STRB DATA(L)	Indicates valid data on top plane data bus.
14	GND	Ground
15-18	TA12(H)-TA15(H)	Top Address lines A12-A15
19	GND	Ground
20-23	TA16(H)-TA19(H)	Top Address lines A16-A19

Table 10-2 (cont)

Line	Mnemonic	Description
24	GND	Ground
25-28	TA20(H)-TA23(H)	Top Address lines A20-A23
29	GND	Ground
30	TB0(H)	(not used)
31	TB1(H)	(not used)
32	TB2(H)	Top Bus line; BG(L) BUS GRANT from 68000 microprocessor.
33	TB3(H)	Top Bus line; HALT(L) from 68000 microprocessor
34	GND	Ground
35	TB4(H)	(not used)
36	TB5(H)	Top Bus line; BERR(L) BUS ERROR from 68000 microprocessor.
37	TB6(H)	Top Bus line; HALT(L) from 68000 microprocessor
38	TB7(H)	(not used)
39	GND	Ground
40	TB8(H)	Top Bus line; BERR(L) BUS ERROR from 68000 microprocessor.
41	TB9(H)	(not used)
42	TB10(H)	Top Bus line; R/W(L) from 68000 microprocessor.
43	TB11(H)	Top Bus line; M/IO (memory=1; IO=0).
44	GND	Ground

Table 10-2 (cont)

Line	Mnemonic	Description
45	TB12(H)	Top Bus line; VPA(L).
46	TB13(H)	Top Bus line; BYTE(H)/WORD(L).
47	TB14(H)	Top Bus line; FC0 function code.
48	TB15(H)	Top Bus line; FC1 function code.
49	TB16(H)	Top Bus line; FC2 function code.
50	GND	Ground

TOP PLANE CONNECTOR P7

The TOP PLANE connector P7 is for connections between the 68000 Emulator Processor and the TTA. This bus does not connect to the Memory Allocation Controller. No special receiver buffering is used on these signals.

Table 10-3
Top Plane Connections for P7

Line	Mnemonic	Description
1	GND	Ground
2	TA0(H)	Part of the TOP PLANE address bus from the Emulator Processor to the TTA.
3--5	TA1(H)-TA3(H)	Top Address Bus; see TA0(H) desc.
6	GND	Ground
7--10	TA4(H)-TA7(H)	Top Address Bus; see TA0(H) desc.
11	GND	Ground
12-15	TA8(H)-TA11(H)	Top Address Bus; see TA0(H) desc.
16	GND	Ground
17	TD0(H)	Part of the TOP PLANE data bus from the Emulator Processor to the TTA.
18-20	TD1(H)-TD3(H)	Top Data Bus; see TD0(H) desc.
21	GND	Ground
22-25	TD4(H)-TD7(H)	Top Data Bus; see TD0(H) desc.
26	GND	Ground
27-30	TD8(H)-TD11(H)	Top Data Bus; see TD0(H) desc.
31	GND	Ground

Table 10-3 (cont)

Line	Mnemonic	Description
32-35	TD12(H)-TD15(H)	Top Data Bus; see TD0(H) desc.
36	GND	Ground
37-44	TP0(H)-TP7(H)	(not used)
45	GND	Ground
46-49	TRIG1(L)-TRIG4(H)	(not used)
50	GND	Ground

MEMORY RESTRICTIONS

Due to the Emulator Processor's operating power levels there are two memory restrictions that must be observed. The 68000 Emulator Processor and the development system's PROM Programmer cannot be selected at the same time. Also a limited memory arrangement is available. The 68000 Emulator Processor can be operated within the following configurations:

With TTA and PROM Programmer installed.

- LAS (1) + MAC (1)
- LAS (1) + 32K (1)
- LAS (2)
- 32K (2)

With TTA installed, but without PROM Programmer.

- LAS (2) + MAC (1)
- LAS (2) + 32K (1)
- LAS (1) + 32K (2)
- 32K (4)

MEMORY CONFIGURATIONS

Table 10-4 shows the memory configurations you may use in your development system in conjunction with the 68000 Emulator Processor. Also included in the table are the recommended jumper positions for each memory configuration.

Table 10-4
J1045 and J2045 Configurations (a)

Memory Configuration	Jumper Configuration(b)		Characteristic
	J1045	J2045	
32K Program Memory board	A1 to A	A1 to A	Normal (no delay)
64K or 128K Static Program Memory board	A1 to A	A1 to A	Normal (no delay)
64K or 128K Static Program Memory board and Memory Allocation Control	A1 to A	A1 to A	Normal (no delay)
32K Program Memory board and Memory Allocation Control	A5 to B	A1 to A	Option (one wait state delay at $\geq 6.4\text{MHz}$) (c)

- (a) Jumper configurations listed are for ≤ 8 MHz operation.
- (b) Jumper configurations not listed for J1045 and J2045 are for future use.
- (c) One wait state is equivalent to one extra clock cycle per memory cycle.

NOTE

J1045 and J2045 are located on the Mobile Microprocessor board. Refer to section 3 of this document for more specific information.

STATUS PORT

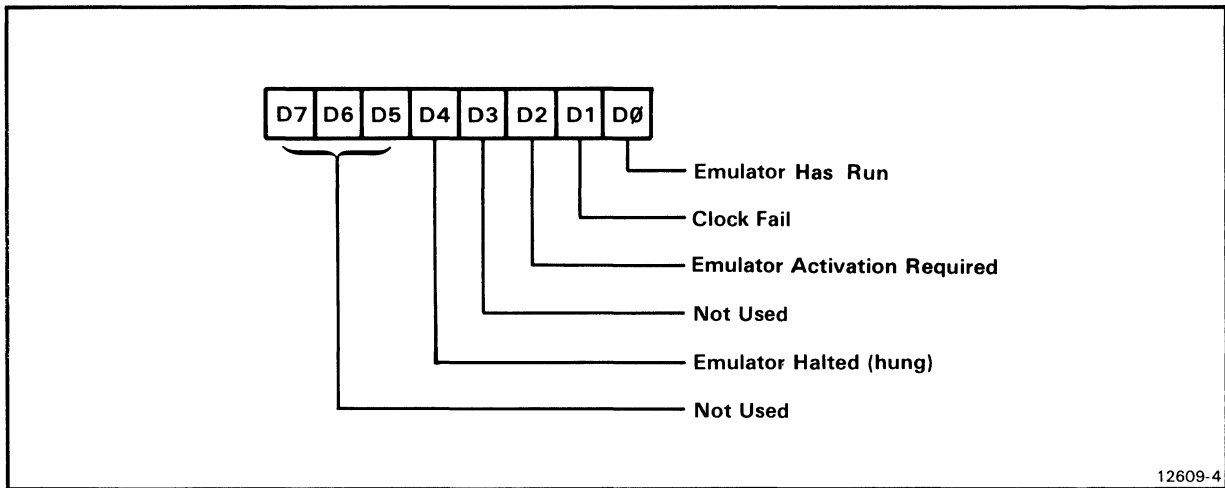


Fig. 10-1. Status byte.

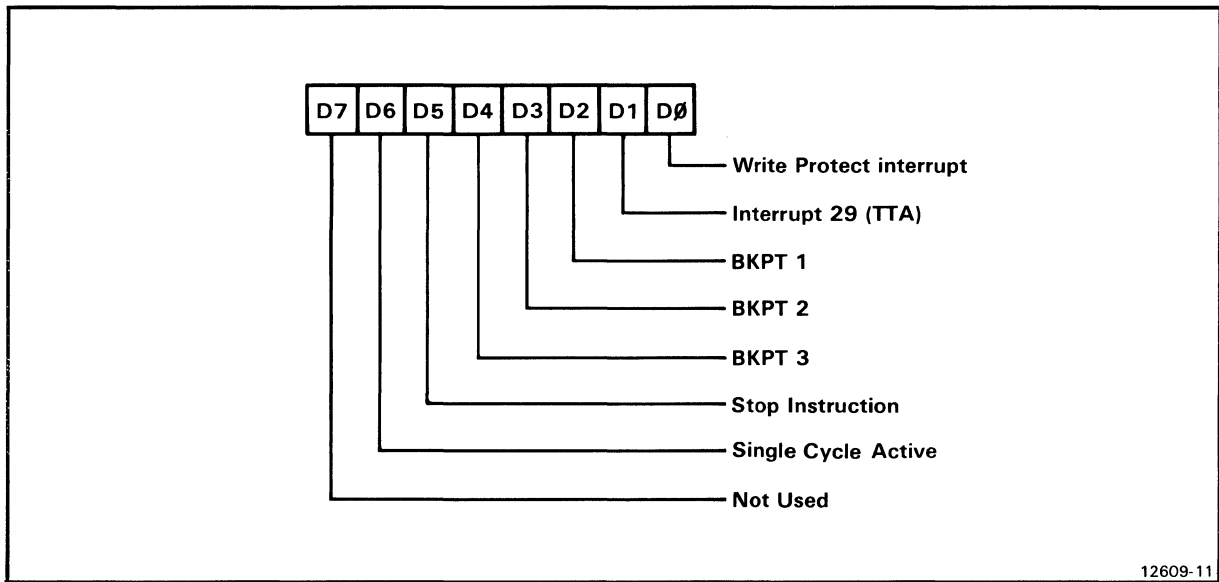


Fig. 10-2. Auxiliary Status byte.

CONTROL PORT

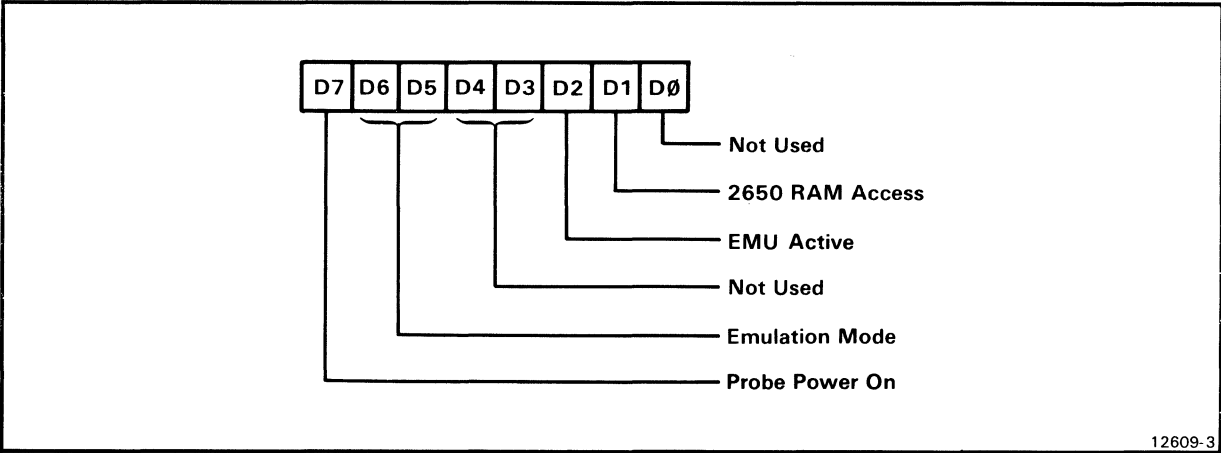


Fig. 10-3. Control byte.

Table 10-5
Emulation Mode Encoding

D6	D5	Function
=====		
L	L	Mode 0
L	H	Mode 1
H	H	Mode 2

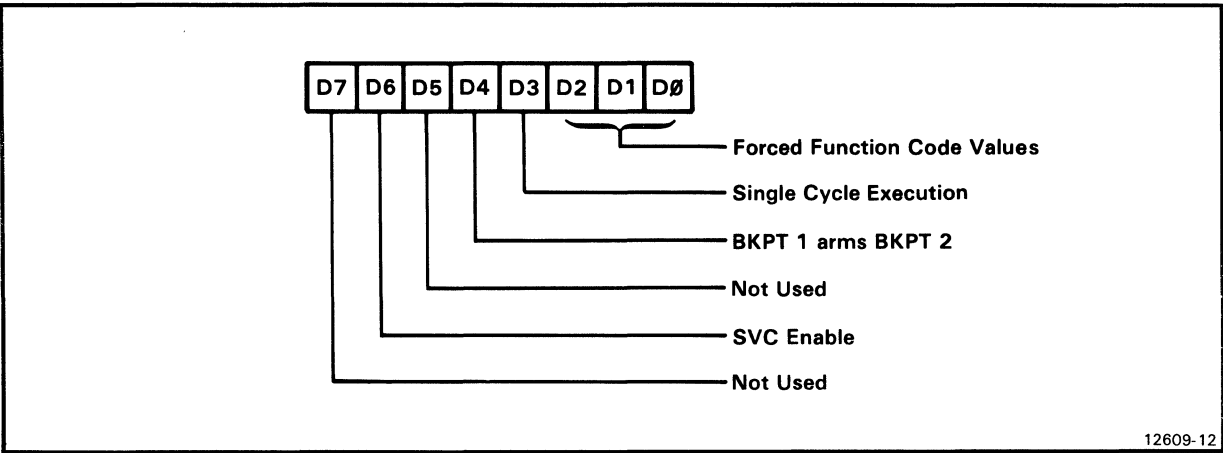


Fig. 10-4. Auxiliary Control byte.

Table 10-6
Forced Function Code Encoding

Forced Function Codes			Memory Space
FFC2	FFC1	FFC0	Accessed
0	0	0	Not Used (a)
0	0	1	User Data
0	1	0	User Code
0	1	1	Not Used (a)
1	0	0	Not Used (a)
1	0	1	Supervisor Data
1	1	0	Supervisor Code
1	1	1	Interrupt

COMMAND PORT

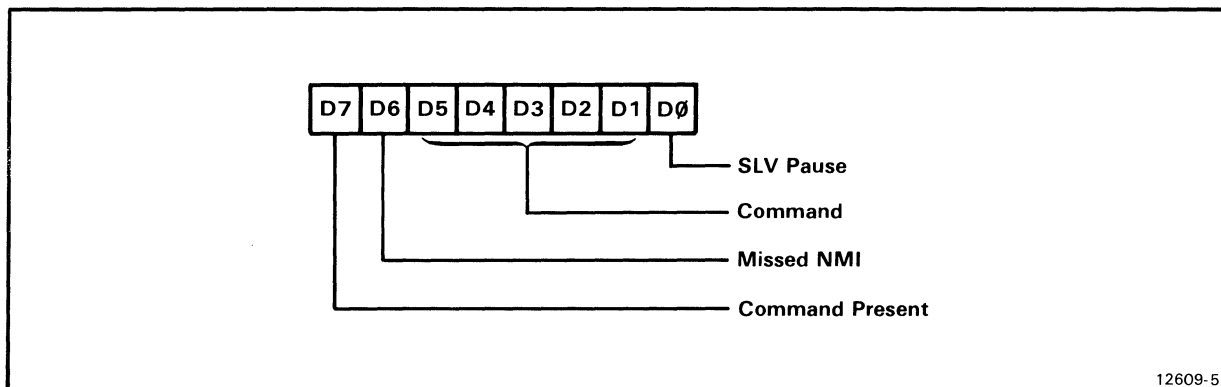


Fig. 10-5. Command Port byte.

Table 10-7
Command Encoding

D5	D4	D3	D2	D1	Command
L	L	L	L	L	Return to user program
L	L	L	L	H	Register Dump
L	L	L	H	L	Register Restore
L	L	L	H	H	UPUT
L	L	H	L	L	UGET
L	L	H	L	H	Readback check
L	L	H	H	L	Execute from Dump and Restore RAM
L	L	H	H	H	Reserved for future use
H	X	X	X	X	Reserved for future use (a)
X	H	X	X	X	Reserved for future use (a)

(a) X = don't care

EMULATOR PROCESSOR RAM

The 68000 Emulator Processor utilizes three different RAM circuits: Breakpoint, Shared Communication, and UMAP/Write Protect. The parameters used by these RAMs are shown in Tables 10-8 through 10-15.

Table 10-8
Emulator Processor RAM Partitioning

2650 Address Space Allocation	68000 Emulator Processor RAM
8000--82FF	Breakpoint RAM
8300--83DF	Not Used
83E0--83FF	Breakpoint RAM
8400--9FFF	Not Used (a)
A000--A7FF	Shared Communication RAM
A800--BFFF	Not Used (b)
C000--FFFF	UMAP/Write Protect RAM

(a) Contains Breakpoint RAM images.

(b) Contains Shared Communication RAM images.

Table 10-9
2650 RAM Access Bit Encoding

2650 Address Lines									Emulator Processor RAM Accessed
A15	A14	A13	A12	A11	A10	A9	A8	A7--A0	
1	0	0	0	0	0	0	0	(a)	BKPT RAM (U3050)
1	0	0	0	0	0	0	1	(a)	BKPT RAM (U3070)
1	0	0	0	0	0	1	0	(a)	BKPT RAM (U3080)
1	0	0	0	0	0	1	1	(a)	BKPT RAM (U3090)
1	0	1	0	0				(a)	Shared Communication RAM
1	1	0	0					(a)	UMAP/Write Protect RAM (User Code)
1	1	0	1					(a)	UMAP/Write Protect RAM (User Data)
1	1	1	0					(a)	UMAP/Write Protect RAM (Supervisor Code)
1	1	1	1					(a)	UMAP/Write Protect RAM (Supervisor Data)

(a) Binary address that is presented directly to the RAMs.

Table 10-10
Breakpoint RAM Partitioning

2650 Address Space	Breakpoint RAM Circuit Number	68000 Microprocessor Address and Control Lines
8000--80FF	U3050	A7--A0
8100--81FF	U3070	A15--A8
8200--82FF	U3080	A23--A16
83E0--83FF	U3090	R/W, B/W, FC2, FC1, and FC0

Table 10-11
Breakpoint RAM Data Out

Data Lines	Description
D1(L)	BKPT 1
D2(L)	BKPT 2
D3(L)	BKPT 3
D4(L)	SVC

Table 10-12
Shared Communication RAM Memory Map

2650 Address	Shared Communication	68000 Microprocessor	
Space	RAM Contents	Address Space	Registers
A000--A003	Register Save	0800--0803	D0
A004--A007		0804--0807	D1
A008--A00B		0808--080B	D2
A00C--A00F		080C--080F	D3
A010--A013		0810--0813	D4
A014--A017		0814--0817	D5
A018--A01B		0818--081B	D6
A01C--A01F		081C--081F	D7
A020--A023		0920--0823	A0
A024--A027		0924--0827	A1
A028--A02B		0928--082B	A2
A02C--A02F		092C--082F	A3
A030--A033		0930--0833	A4
A034--A037		0934--0837	A5
A038--A03B		0938--083B	A6
A03C--A03F	Supervisor Stack Pointer	083C--083F	
A040--A043	User Stack Pointer	0840--0843	
A044--A045	Status Register	0844--0845	
A046--A047	PC Next (High)	0846--0847	
A048--A049	PC Next (Low)	0848--0849	
A04A--A04B	NMI Missed (Flag)	084A--084B	
A04C--A04F	Prototype Address	084C--084F	
A050--A051	Byte Count	0850--0851	
A052--A053	Byte/Word	0852--0853	
A054--A055	Command Completion Status	0854--0855	
A056--A059	Error Address	0856--0859	
A05A--A7F5	Buffer Block	085A--0FF5	
A7F6--A7F7	PROM Stack	0FF6--0FF7	
A7F8--A7FF	Interrupt Trapstack	0FF8--0FFF	

Table 10-13
UMAP/Write Protect RAM Partitioning

2650 Address Space	Memory Space Accessed	Circuit Numbers	RAM Function
C000--CFFF	User Data	U3010	Mapping
		U4010	Write Protect
D000--DFFF	User Code	U3020	Mapping
		U4020	Write Protect
E000--EFFF	Supervisor Data	U3030	Mapping
		U4030	Write Protect
F000--FFFF	Supervisor Code	U3040	Mapping
		U4040	Write Protect

Table 10-14
UMAP/Write Protect RAM Data Out

Data Lines		Description	
D1	D0	Write Protect	Map to:
0	0	Yes	Prototype Memory
0	1	Yes	Program Memory
1	0	No	Prototype Memory
1	1	No	Program Memory

Table 10-15
Addresses Presented to the UMAP/Write Protect RAMs

2650 Address Lines	68000 Microprocessor Address Lines
A13	FC2
A12	FC1
A11	A23
A10	A22
A9	A21
A8	A20
A3	A19
A2	A18
A1	A17
A0	A16
A7	A15
A6	A14
A5	A13
A4	A12

PROBE TIP TIMING

Table 10-16 lists a comparison of timing relationships between the MC68000L microprocessor chip and the 68000 Emulator Processor. Timing relationships listed in Table 10-16 are illustrated in Figures 10-6 and 10-7.

Table 10-16
AC Electrical Characteristics

Number	Characteristic	Symbol	Processor		Emulator		Unit
			Min	Max	Min	Max	
1	Clock Period	'cyc	125	500	125	500	ns
2	Clock Width Low	'CL	55	250	55	250	ns
3	Clock Width High	'CH	55	250	55	250	ns
4	Clock Fall Time	'Cf	—	10	—	10	ns
5	Clock Rise Time	'Cr	—	10	—	10	ns
6	Clock Low to Address	'CLAV	—	70	—	92	ns
6A	Clock High to FC(H) Valid	'CHFCV	—	70	—	92	ns
7A	Clock High to Address High Impedance (Max.)	'CHAZx	—	80	—	114	ns
7B	Clock High to Data High Impedance (Max.)	'CHDZx	—	80	—	130	ns
8	Clock High to Address/FC(H) Invalid (Min.)	'CHAZn	0	—	14	—	ns
9 ¹	Clock High to AS(L), DS(L) Low (Max.)	'CHSLx	—	60	—	86	ns
10	Clock High to AS(L), DS(L) Low (Min.)	'CHSLn	0	—	14	—	ns
11 ²	Address to AS(L), DS(L) Low/AS(L) Write	'AVSL	30	—	24	—	ns
11A ²	FC(H) Valid to AS(L), DS(L) (Read) Low/AS(L) Write	'FCVSL	60	—	44	—	ns
12 ¹	Clock Low to AS(L), DS(L) High	'CLSH	—	70	—	96	ns
13 ²	AS(L), DS(L) High to Address/FC(H) Invalid	'SHAZ	30	—	20	—	ns
14 ^{2,5}	AS(L), DS(L) Width Low (Read)/AS(L) Write	'SL	240	—	240	—	ns
14A ²	DS(L) Width Low (Write)	—	115	—	115	—	ns
15 ²	AS(L), DS(L) Width High	'SH	150	—	150	—	ns
16	Clock High to AS(L), DS(L) High Impedance	'CHSZ	—	80	—	93	ns
17 ²	AS(L), DS(L) High to R(H)/W(L) High	'SHRH	40	—	40	—	ns
18 ¹	Clock High to R(H)/W(L) High (Max.)	'CHRHx	—	70	—	96	ns
19	Clock High to R(H)/W(L) High (Min.)	'CHRHn	0	—	14	—	ns
20 ¹	Clock High to R(H)/W(L) Low	'CHRL	—	70	—	96	ns
21 ²	Address Valid to R(H)/W(L) Low	'AVRL	20	—	14	—	ns
21A ²	FC(H) Valid to R(H)/W(L) Low	'FCVRL	60	—	54	—	ns
22 ²	R(H)/W(L) Low to DS(L) Low (Write)	'RLSL	80	—	80	—	ns
23	Clock Low to Data Out(H) Valid	'CLDO	—	70	—	95	ns
25 ²	DS(L) High to Data Out(H) Invalid	'SHDO	30	—	20	—	ns
26 ²	Data Out(H) Valid to DS(L) Low (Write)	'DOSL	30	—	20	—	ns
27 ⁶	Data In to Clock Low (Setup Time)	'DIDL	15	—	17	—	ns
28 ²	AS(L), DS(L) High to DTACK(L) High	'SHDAH	0	120	0	94	ns
29	DS(L) High to Data Invalid (Hold Time)	'SHDI	0	—	0	—	ns
30	AS(L), DS(L) High to BERR(L) High	'SHBEH	0	—	0	—	ns
31 ^{2,6}	DTACK(L) Low to Data In (Setup Time)	'DALDI	—	90	—	88	ns
32	HALT(L) and RESET(L) Input Transition Time	'RHrf	0	200	0	200	ns
33	Clock High to BG(L) Low	'CHGL	—	70	—	93	ns
34	Clock High to BG(H) High	'CHGH	—	70	—	93	ns
35 ⁷	BR(L) Low to BG(L) Low	'BRLGL	1.5	3	1.5	3	Clk Per
36 ⁷	BR(L) High to BG(L) High	'BRHGH	1.5	3	1.5	3	Clk Per
37	BGACK(L) Low to BG(L) High	'GALGH	1.5	3	1.5	3	Clk Per
38	BG(L) Low to Bus High Impedance (With AS(L) High)	'GLZ	—	80	—	148	ns
39	BG(L) Width High	'GH	1.5	—	1.5	—	Clk Per
46	BGACK(L) Width	'BGL	1.5	—	1.5	—	Clk Per
47 ^{6,8}	Asynchronous Input Setup Time	'ASI	20	—	20	—	ns
48	BERR(L) Low to DTACK(L) Low ³	'BELDAL	50	—	50	—	ns
53	Data Hold from Clock High	'CHDO	0	—	0	—	ns
55	R(H)/W(L) to Data Bus Impedance Change	'RLDO	30	—	20	—	ns
56	HALT(H)/RESET(L) Pulse Width ⁴	'HRPW	10	—	10	—	Clk Per

¹ For a loading capacitance of less than or equal to 50 picofarads, subtract 5 nanoseconds from the values given in these columns.

² Actual value depends on clock period.

³ If #47 is satisfied for both DTACK(L) and BERR(L), #48 may be 0 ns.

⁴ After Vcc has been applied for 100 ms.

⁵ For T6E, BF4, and R9M mask sets #14 and #14A are one clock period less than the given number.

⁶ If the asynchronous setup time (#47) requirements are satisfied, the DTACK(L) low-to-data setup time (#31) requirement can be ignored. The data must only satisfy the data-in to clock-low setup time (#27) for the following cycle.

⁷ For the Probe-tip add 20 nanoseconds to the clock periods listed.

⁸ VPA = 50 nanoseconds for the Probe-tip.

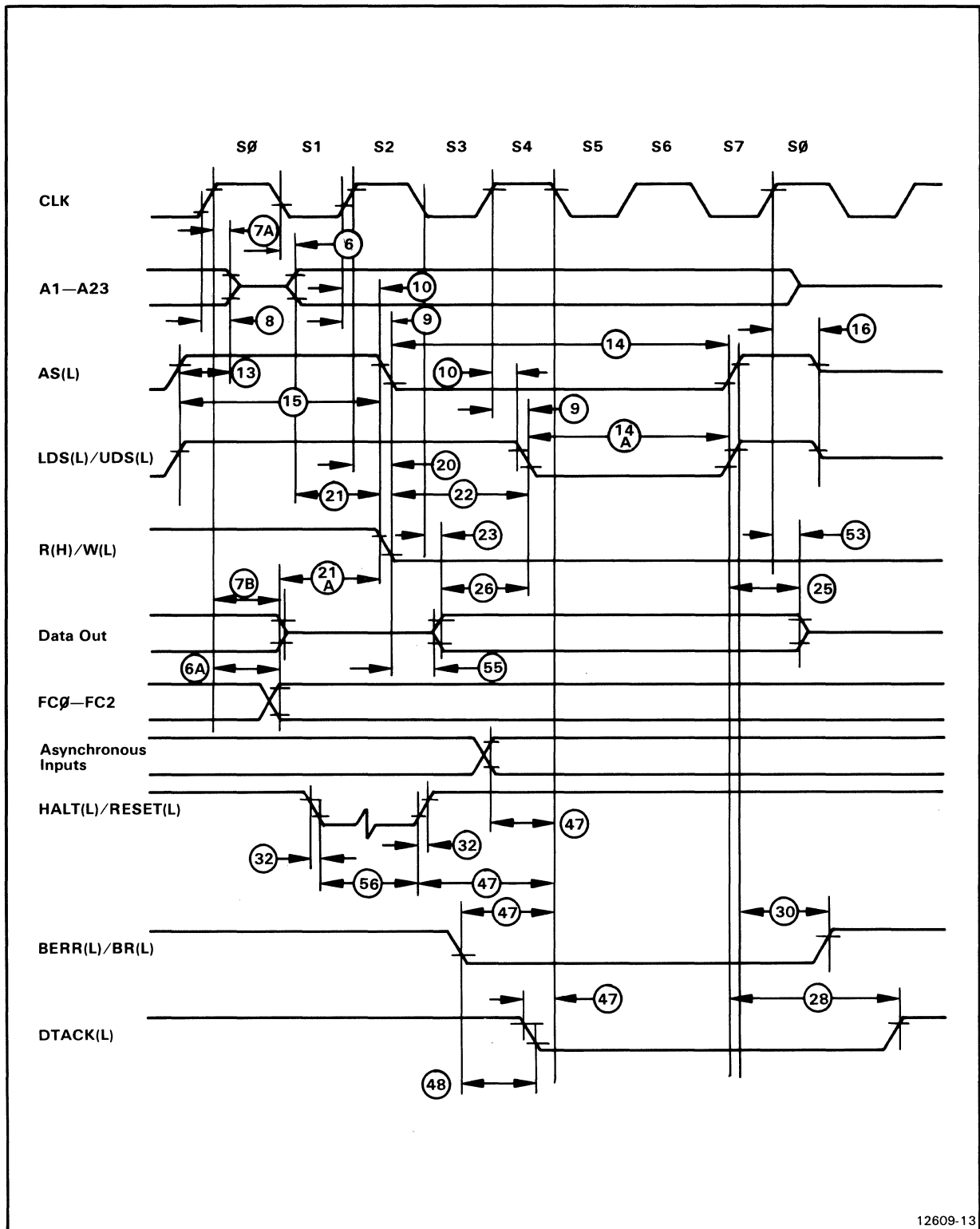
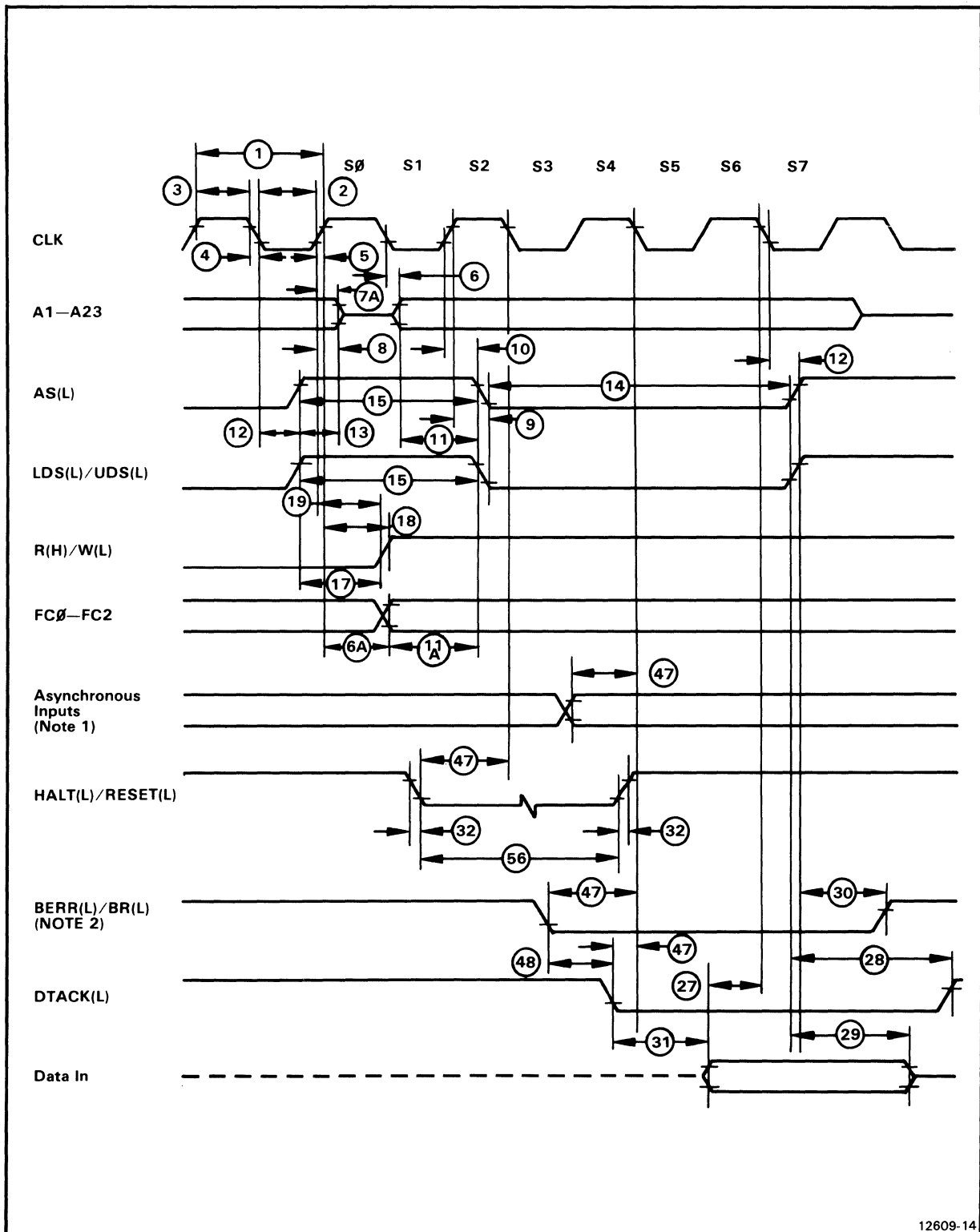


Fig. 10-6. 68000 timing relationships



12609-14

Fig. 10-7. 68000 timing relationships continued.

MC68000 PIN ASSIGNMENTS

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D4	- 1		64 - D5
D3	- 2		63 - D6
D2	- 3		62 - D7
D1	- 4		61 - D8
D0	- 5		60 - D9
AS(L)	- 6		59 - D10
UDS(L)	- 7		58 - D11
LDS(L)	- 8		57 - D12
R/W(L)	- 9		56 - D13
DTACK(L)	- 10		55 - D14
BG(L)	- 11		54 - D15
BGACK(L)	- 12	M	53 - Vss
BR(L)	- 13	C	52 - A23
Vdd	- 14	6	51 - A22
CLK	- 15	8	50 - A21
Vss	- 16	0	49 - Vdd
HALT(L)	- 17	0	48 - A20
RESET(L)	- 18	0	47 - A19
VMA(L)	- 19	L	46 - A18
E	- 20		45 - A17
VPA(L)	- 21		44 - A16
BERR(L)	- 22		43 - A15
IPL2(L)	- 23		42 - A14
IPL1(L)	- 24		41 - A13
IPL0(L)	- 25		40 - A12
FC2	- 26		39 - A11
FC1	- 27		38 - A10
FC0	- 28		37 - A9
A1	- 29		36 - A8
A2	- 30		35 - A7
A3	- 31		34 - A6
A4	- 32		33 - A5

SECTION 11

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

Only the circuit number will appear on the diagrams and circuit board illustrations. Each diagram and circuit board illustration is clearly marked with the assembly number. Assembly numbers are also marked on the mechanical exploded views located in the Mechanical Parts List. The component number is obtained by adding the assembly number prefix to the circuit number.

The Electrical Parts List is divided and arranged by assemblies in numerical sequence (e.g., assembly A1 with its subassemblies and parts, precedes assembly A2 with its subassemblies and parts).

Chassis-mounted parts have no assembly number prefix and are located at the end of the Electrical Parts List.

LIST OF ASSEMBLIES

A list of assemblies can be found at the beginning of the Electrical Parts List. The assemblies are listed in numerical order. When the complete component number of a part is known, this list will identify the assembly in which the part is located.

CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

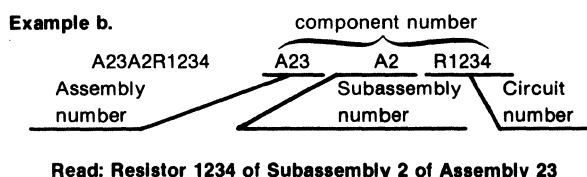
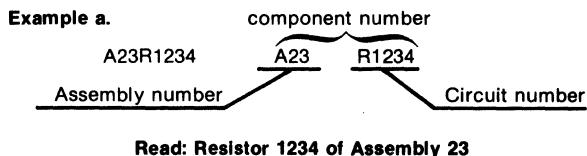
The Mfr. Code Number to Manufacturer index for the Electrical Parts List is located immediately after this page. The Cross Index provides codes, names and addresses of manufacturers of components listed in the Electrical Parts List.

ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (column one of the Electrical Parts List)

A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:



TEKTRONIX PART NO. (column two of the Electrical Parts List)

Indicates part number to be used when ordering replacement part from Tektronix.

SERIAL/MODEL NO. (columns three and four of the Electrical Parts List)

Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the serial number at which the part was removed. No serial number entered indicates part is good for all serial numbers.

NAME & DESCRIPTION (column five of the Electrical Parts List)

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

MFR. CODE (column six of the Electrical Parts List)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

MFR. PART NUMBER (column seven of the Electrical Parts List)

Indicates actual manufacturers part number.

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
01807	PETERSEN RADIO COMPANY, INC.	2800 WEST BROADWAY	COUNCIL BLUFFS, IN 51501
03508	GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT	ELECTRONICS PARK	SYRACUSE, NY 13201
04222	AVX CERAMICS, DIVISION OF AVX CORP.	P O BOX 867, 19TH AVE. SOUTH	MYRTLE BEACH, SC 29577
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD, PO BOX 20923	PHOENIX, AZ 85036
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
18324	SIGNETICS CORP.	811 E. ARQUES	SUNNYVALE, CA 94086
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
32440	ENGINEERED COMPONENTS CO.	3580 SACRAMENTO DR.	SAN LUIS OBISPO, CA 93406
34335	ADVANCED MICRO DEVICES	901 THOMPSON PL.	SUNNYVALE, CA 94086
34649	INTEL CORP.	3065 BOWERS AVE.	SANTA CLARA, CA 95051
50434	HEWLETT-PACKARD COMPANY	640 PAGE MILL ROAD	PALO ALTO, CA 94304
50522	MONSANTO CO., ELECTRONIC SPECIAL PRODUCTS	3400 HILLVIEW AVENUE	PALO ALTO, CA 94304
54473	MATSUSHITA ELECTRIC, CORP. OF AMERICA	1 PANASONIC WAY	SECAUCUS, NJ 07094
55680	NICHICON/AMERICA/CORP.	6435 N PROESEL AVENUE	CHICAGO, IL 60645
59660	TUSONIX INC.	2155 N FORBES BLVD	TUCSON, AZ 85705
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
90095	TECHNITROL INC.	1952 ALLEGHENY AVE.	PHILADELPHIA, PA 19134
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY AND CO., INC.	3029 E. WASHINGTON STREET	INDIANAPOLIS, IN 46206
91637	DALE ELECTRONICS, INC.	P. O. BOX 372 P. O. BOX 609	COLUMBUS, NE 68601

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A10	670 7301-00		CKT BOARD ASSY:EMULATOR I	80009	670-7301-00
A15	670-7302-00		CKT BOARD ASSY:EMULATOR II	80009	670-7302-00
A20	670-7304-00		CKT BOARD ASSY:CABLE TERMINATION	80009	670-7304-00
A30	670-7303-00		CKT BOARD ASSY:BUFFER	80009	670-7303-00
A35	670-7305-00		CKT BOARD ASSY:68000 MOBILE	80009	670-7305-00
A40	670-7300-00		CKT BOARD ASSY:68000 CONTROL	80009	670-7300-00
A50	670-7235-00		CKT BOARD ASSY:POWER SUPPLY	80009	670-7235-00
A60	-----		PROBE ASSY:68000		
	-----		(REPLACEABLE AS 175-4575-00 ONLY)		
A10	-----		CKT BOARD ASSY:EMULATOR I		
A10C2012	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C2022	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C2032	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C2042	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C2052	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C2062	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C2082	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C2092	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C2141	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C2162	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C2172	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C2182	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C2218	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C2219	283-0115-00		CAP.,FXD,CER DI:47PF,5%,200V	59660	805-519-COG0470J
A10C2221	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C3022	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C3032	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C3042	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C3052	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C3062	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C3082	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C3092	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C3223	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4012	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4022	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4032	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4042	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4052	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4062	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4082	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4092	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4102	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4112	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4122	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4142	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4152	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4162	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4172	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4182	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4192	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4202	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C4222	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C5012	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C5022	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z

Replaceable Electrical Parts—68000 E.P. Service

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A10C5032	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C5042	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C5052	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C5062	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C5082	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C5092	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C5102	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C5112	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C5122	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C5192	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C5202	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C5212	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C5222	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6012	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6022	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6032	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6042	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6044	290-0746-00		CAP.,FXD,ELCTLT:47UF,+50-10%,16V	55680	16U-47V-T
A10C6052	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6062	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6072	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6082	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6092	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6102	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6112	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6122	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6132	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6142	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6159	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6162	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6171	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6172	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6192	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6202	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6212	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10C6222	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A10DL4030	119-1407-00		DELAY LINE,ELEC:100NS,TAPPED,14 PIN	32440	TTLDM100
A10R1012	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A10R2014	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A10R2161	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A10R2181	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A10R2212	315-0821-00		RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
A10R2214	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A10R2216	315-0821-00		RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
A10R2217	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A10R6024	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A10RP2111	307-0675-00		RES NTWK,FXD FI:9,1K OHM,2%,1.25W	01121	210A102
A10RP2121	307-0445-00		RES NTWK,FXD FI:4.7K OHM,20%,(9) RES	91637	MSP10A01-472M
A10RP3111	307-0445-00		RES NTWK,FXD FI:4.7K OHM,20%,(9) RES	91637	MSP10A01-472M
A10RP6151	307-0675-00		RES NTWK,FXD FI:9,1K OHM,2%,1.25W	01121	210A102
A10RP6182	307-0675-00		RES NTWK,FXD FI:9,1K OHM,2%,1.25W	01121	210A102
A10U1220	156-0718-03		MICROCIRCUIT,DI:TRIPLE 3-INP NOR GATE	01295	SN74LS27
A10U2020	156-1058-01		MICROCIRCUIT,DI:OCTAL ST BFR W/3 STATE OUT	01295	SN74S240JP4
A10U2030	156-1065-01		MICROCIRCUIT,DI:OCTAL D TYPE TRANS LATCHES	34335	AM74LS373
A10U2040	156-1179-01		MICROCIRCUIT,DI:OCTAL BFR,W/3STATE OUT	01295	SN74S241 JP3
A10U2050	156-1058-01		MICROCIRCUIT,DI:OCTAL ST BFR W/3 STATE OUT	01295	SN74S240JP4
A10U2060	156-1058-01		MICROCIRCUIT,DI:OCTAL ST BFR W/3 STATE OUT	01295	SN74S240JP4

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A10U2080	156-0865-02		MICROCIRCUIT,DI:OCTAL D-TYPE FF W/CLEAR	01295	SN74LS273NP3
A10U2090	156-0956-02		MICROCIRCUIT,DI:OCTAL BFR W/3STATE OUT	01295	SN74LS244NP3
A10U2140	156-0118-03		MICROCIRCUIT,DI:1 DUAL J-K FF,BURN-IN	01295	SN74S112JP3
A10U2160	156-0724-02		MICROCIRCUIT,DI:HEX INV W/OC OUT,BURN-IN	01295	SN74LS05
A10U2170	156-0388-03		MICROCIRCUIT,DI:DUAL D FLIP-FLOP	07263	74LS74A
A10U2180	156-1059-01		MICROCIRCUIT,DI:DUAL J-K EDGETRIGGERED	01295	SN74LS109A
A10U2190	156-1058-01		MICROCIRCUIT,DI:OCTAL ST BFR W/3 STATE OUT	01295	SN74S240JP4
A10U2210	156-0323-02		MICROCIRCUIT,DI:HEX INVERTER,BURN-IN	01295	SN74S04
A10U2220	156-0392-03		MICROCIRCUIT,DI:QUAD LATCH W/CLEAR	01295	SN74S175NP3
A10U3010	156-0383-02		MICROCIRCUIT,DI:QUAD 2-INP NOR GATE	01295	SN74LS02
A10U3020	156-0418-01		MICROCIRCUIT,DI:8 INPUT NAND GATE,SCRN	01295	SN74S30
A10U3030	156-0690-03		MICROCIRCUIT,DI:QUAD 2 INP NOR GATE,BURN IN	01295	SN74S02
A10U3040	156-0320-03		MICROCIRCUIT,DI:TRIPLE 3 INP NAND GATE	01295	SN74S11NP3
A10U3050	156-0690-03		MICROCIRCUIT,DI:QUAD 2 INP NOR GATE,BURN IN	01295	SN74S02
A10U3060	156-0464-02		MICROCIRCUIT,DI:DUAL 4 INP NAND GATE	01295	SN74LS20
A10U3080	156-0985-01		MICROCIRCUIT,DI:HEX INVERTER,BURN-IN	04713	SN74LS260
A10U3090	156-0966-01		MICROCIRCUIT,DI:DUAL 5 INP NOR GATES	80009	156-0966-01
A10U4010	156-0382-02		MICROCIRCUIT,DI:QUAD 2-INP NAND GATE	01295	SN74LS00
A10U4020	156-0323-02		MICROCIRCUIT,DI:HEX INVERTER,BURN-IN	01295	SN74S04
A10U4040	156-0707-03		MICROCIRCUIT,DI:QUAD 2 INP EXCL OR GATE	07263	74S86
A10U4050	156-0180-04		MICROCIRCUIT,DI:QUAD 2 INP NAND GATE	01295	SN74S00NP3
A10U4060	156-0323-02		MICROCIRCUIT,DI:HEX INVERTER,BURN-IN	01295	SN74S04
A10U4080	156-0459-02		MICROCIRCUIT,DI:QUAD 2 INPUT & GATE,BURN	01295	SN74S08
A10U4090	156-0180-04		MICROCIRCUIT,DI:QUAD 2 INP NAND GATE	01295	SN74S00NP3
A10U4100	156-0385-02		MICROCIRCUIT,DI:HEX INVERTER	01295	SN74LS04
A10U4110	156-0703-02		MICROCIRCUIT,DI:4-2-3-2 INPUT& OR GATE	07263	74S64
A10U4120	156-0703-02		MICROCIRCUIT,DI:4-2-3-2 INPUT& OR GATE	07263	74S64
A10U4140	156-1065-01		MICROCIRCUIT,DI:OCTAL D TYPE TRANS LATCHES	34335	AM74LS373
A10U4150	156-0956-02		MICROCIRCUIT,DI:OCTAL BFR W/3STATE OUT	01295	SN74LS244NP3
A10U4160	156-0956-02		MICROCIRCUIT,DI:OCTAL BFR W/3STATE OUT	01295	SN74LS244NP3
A10U4170	156-1065-01		MICROCIRCUIT,DI:OCTAL D TYPE TRANS LATCHES	34335	AM74LS373
A10U4180	156-1065-01		MICROCIRCUIT,DI:OCTAL D TYPE TRANS LATCHES	34335	AM74LS373
A10U4190	156-1065-01		MICROCIRCUIT,DI:OCTAL D TYPE TRANS LATCHES	34335	AM74LS373
A10U4200	156-1065-01		MICROCIRCUIT,DI:OCTAL D TYPE TRANS LATCHES	34335	AM74LS373
A10U4220	156-0392-03		MICROCIRCUIT,DI:QUAD LATCH W/CLEAR	01295	SN74S175NP3
A10U5010	156-0386-02		MICROCIRCUIT,DI:TRIPLE 3 INP NAND GATE	01295	SN74LS10NP3
A10U5030	156-0690-03		MICROCIRCUIT,DI:QUAD 2 INP NOR GATE,BURN IN	01295	SN74S02
A10U5040	156-0739-02		MICROCIRCUIT,DI:QUAD 2 INP ORGATE,SCRN	01295	SN74S32
A10U5050	156-0459-02		MICROCIRCUIT,DI:QUAD 2 INPUT & GATE,BURN	01295	SN74S08
A10U5060	156-0180-04		MICROCIRCUIT,DI:QUAD 2 INP NAND GATE	01295	SN74S00NP3
A10U5080	156-0739-02		MICROCIRCUIT,DI:QUAD 2 INP ORGATE,SCRN	01295	SN74S32
A10U5090	156-0383-02		MICROCIRCUIT,DI:QUAD 2-INP NOR GATE	01295	SN74LS02
A10U5100	156-0382-02		MICROCIRCUIT,DI:QUAD 2-INP NAND GATE	01295	SN74LS00
A10U5110	156-0385-02		MICROCIRCUIT,DI:HEX INVERTER	01295	SN74LS04
A10U5120	156-0479-02		MICROCIRCUIT,DI:QUAD 2-INP ORGATE	01295	SN74LS32NP3
A10U5140	160-1308-00		MICROCIRCUIT,DI:1024 X 8 PROM	80009	160-1308-00
A10U5160	160-1309-00		MICROCIRCUIT,DI:1024 X 8 PROM	80009	160-1309-00
A10U5170	160-1310-00		MICROCIRCUIT,DI:1024 X 8 PROM	80009	160-1310-00
A10U5190	156-1614-00		MICROCIRCUIT,DI:SRAM,1024 X 4,W/3 STATE	34649	D2114AL-3
A10U5200	156-1614-00		MICROCIRCUIT,DI:SRAM,1024 X 4,W/3 STATE	34649	D2114AL-3
A10U5210	156-1614-00		MICROCIRCUIT,DI:SRAM,1024 X 4,W/3 STATE	34649	D2114AL-3
A10U5220	156-1614-00		MICROCIRCUIT,DI:SRAM,1024 X 4,W/3 STATE	34649	D2114AL-3
A10U6010	156-1059-01		MICROCIRCUIT,DI:DUAL J-K EDGETRIGGERED	01295	SN74LS109A
A10U6020	156-0331-03		MICROCIRCUIT,DI:DUAL D TYPE POSITIVE EDGE	80009	156-0331-03
A10U6030	156-1059-01		MICROCIRCUIT,DI:DUAL J-K EDGETRIGGERED	01295	SN74LS109A
A10U6040	156-0180-04		MICROCIRCUIT,DI:QUAD 2 INP NAND GATE	01295	SN74S00NP3
A10U6050	156-1058-01		MICROCIRCUIT,DI:OCTAL ST BFR W/3 STATE OUT	01295	SN74S240JP4

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Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A10U6060	156-0914-02		MICROCIRCUIT,DI:OCT ST BFR W/3 STATE OUT	01295	SN74LS240
A10U6070	156-1058-01		MICROCIRCUIT,DI:OCTAL ST BFR W/3 STATE OUT	01295	SN74S240JP4
A10U6080	156-0914-02		MICROCIRCUIT,DI:OCT ST BFR W/3 STATE OUT	01295	SN74LS240
A10U6090	156-1058-01		MICROCIRCUIT,DI:OCTAL ST BFR W/3 STATE OUT	01295	SN74S240JP4
A10U6100	156-0914-02		MICROCIRCUIT,DI:OCT ST BFR W/3 STATE OUT	01295	SN74LS240
A10U6110	156-1058-01		MICROCIRCUIT,DI:OCTAL ST BFR W/3 STATE OUT	01295	SN74S240JP4
A10U6120	156-0914-02		MICROCIRCUIT,DI:OCT ST BFR W/3 STATE OUT	01295	SN74LS240
A10U6130	156-1058-01		MICROCIRCUIT,DI:OCTAL ST BFR W/3 STATE OUT	01295	SN74S240JP4
A10U6160	156-0804-02		MICROCIRCUIT,DI:QUADRUPL S-RLATCH,SCRN	01295	SN74LS279NP3
A10U6170	156-0392-03		MICROCIRCUIT,DI:QUAD LATCH W/CLEAR	01295	SN74S175NP3
A10U6190	156-0956-02		MICROCIRCUIT,DI:OCTAL BFR W/3STATE OUT	01295	SN74LS244NP3
A10U6200	156-1111-02		MICROCIRCUIT,DI:OCTAL BUS TRANSCEIVERS	80009	156-1111-02
A10U6210	156-1111-02		MICROCIRCUIT,DI:OCTAL BUS TRANSCEIVERS	80009	156-1111-02
A10U6220	156-1111-02		MICROCIRCUIT,DI:OCTAL BUS TRANSCEIVERS	80009	156-1111-02
A10Y3228	158-0115-00		XTAL UNIT,QTZ:16MHZ,0.01%,SERIES	01807	7-13P

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A15	-----		CKT BOARD ASSY:EMULATOR II		
A15C1071	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C1072	290-0782-00		CAP.,FXD,ELCTLT:4.7UF,+75-10%,35V	55680	35ULA4R7V-T
A15C1081	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C1101	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C1111	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C1121	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C1141	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C2011	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C2031	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C2051	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C2091	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C2102	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C2121	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C2141	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C2161	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C3011	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C3021	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C3031	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C3041	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C3051	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C3071	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C3081	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C3091	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C3101	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C3121	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C3141	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C3161	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C4011	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C4021	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C4031	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C4041	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C4061	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C4081	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C4101	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C4121	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C4142	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C4161	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C5021	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C5022	290-0846-00		CAP.,FXD,ELCTLT:47UF,-10+75%,35 WVDC	54473	ECE-A35V47LU
A15C5041	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C5072	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C5092	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C5101	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C5112	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C5121	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C5141	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15C5161	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A15R1091	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A15R1092	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A15R1093	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A15R1122	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R1131	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R2041	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R2122	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R2123	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R2151	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025

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Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A15R2152	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R3042	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R3151	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R4042	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R4091	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R4162	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R5071	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R5091	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R5111	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R5131	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R5151	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15U1070	156-0522-02		MICROCIRCUIT,DI:QUAD 2-INP MUX W/3 STATE	07263	74S257
A15U1080	156-0529-02		MICROCIRCUIT,DI:DATA SELECTOR	01295	SN74S257NP3
A15U1090	156-0529-02		MICROCIRCUIT,DI:DATA SELECTOR	01295	SN74S257NP3
A15U1110	156-0690-03		MICROCIRCUIT,DI:QUAD 2 INP NOR GATE,BURN IN	01295	SN74S02
A15U1120	156-0465-02		MICROCIRCUIT,DI:8 INP NAND GATE	01295	SN74LS30NP3
A15U1130	156-0331-03		MICROCIRCUIT,DI:DUAL D TYPE POSITIVE EDGE	80009	156-0331-03
A15U1140	156-0480-02		MICROCIRCUIT,DI:QUAD 2 INP & GATE	01295	SN74LS08NP3
A15U2100	156-0385-02		MICROCIRCUIT,DI:HEX INVERTER	01295	SN74LS04
A15U2010	156-0529-02		MICROCIRCUIT,DI:DATA SELECTOR	01295	SN74S257NP3
A15U2020	156-0529-02		MICROCIRCUIT,DI:DATA SELECTOR	01295	SN74S257NP3
A15U2030	156-0522-02		MICROCIRCUIT,DI:QUAD 2-INP MUX W/3 STATE	07263	74S257
A15U2040	156-0321-02		MICROCIRCUIT,DI:TRIPLE 3 INP NAND GATE	01295	SN74S10
A15U2050	156-0418-01		MICROCIRCUIT,DI:8 INPUT NAND GATE,SCRN	01295	SN74S30
A15U2060	156-0982-03		MICROCIRCUIT,DI:OCTAL-D-EDGE FF,SCRN	07263	74LS374
A15U2070	156-0522-02		MICROCIRCUIT,DI:QUAD 2-INP MUX W/3 STATE	07263	74S257
A15U2080	156-0522-02		MICROCIRCUIT,DI:QUAD 2-INP MUX W/3 STATE	07263	74S257
A15U2090	156-0381-02		MICROCIRCUIT,DI:QUAD 2-INP EXCL OR GATE	01295	SN74LS86
A15U2110	156-0323-02		MICROCIRCUIT,DI:HEX INVERTER,BURN-IN	01295	SN74S04
A15U2120	156-1059-01		MICROCIRCUIT,DI:DUAL J-K EDGETRIGGERED	01295	SN74LS109A
A15U2130	156-0910-02		MICROCIRCUIT,DI:DUAL DECADE COUNTER	01295	SN74LS390
A15U2140	156-0910-02		MICROCIRCUIT,DI:DUAL DECADE COUNTER	01295	SN74LS390
A15U2150	156-0388-03		MICROCIRCUIT,DI:DUAL D FLIP-FLOP	07263	74LS74A
A15U3100	156-0382-02		MICROCIRCUIT,DI:QUAD 2-INP NAND GATE	01295	SN74LS00
A15U3010	156-1613-00		MICROCIRCUIT,DI:SRAM,4096 X 1,W/3 STATE	34649	D2147HL-3
A15U3020	156-1613-00		MICROCIRCUIT,DI:SRAM,4096 X 1,W/3 STATE	34649	D2147HL-3
A15U3030	156-1613-00		MICROCIRCUIT,DI:SRAM,4096 X 1,W/3 STATE	34649	D2147HL-3
A15U3040	156-1613-00		MICROCIRCUIT,DI:SRAM,4096 X 1,W/3 STATE	34649	D2147HL-3
A15U3050	156-1293-00		MICROCIRCUIT,DI:256 X 4 STATIC RAM	07263	93L422SUPRIILB
A15U3070	156-1293-00		MICROCIRCUIT,DI:256 X 4 STATIC RAM	07263	93L422SUPRIILB
A15U3080	156-1293-00		MICROCIRCUIT,DI:256 X 4 STATIC RAM	07263	93L422SUPRIILB
A15U3090	156-1293-00		MICROCIRCUIT,DI:256 X 4 STATIC RAM	07263	93L422SUPRIILB
A15U3110	156-0479-02		MICROCIRCUIT,DI:QUAD 2-INP ORGATE	01295	SN74LS32NP3
A15U3120	156-1059-01		MICROCIRCUIT,DI:DUAL J-K EDGETRIGGERED	01295	SN74LS109A
A15U3130	156-0469-02		MICROCIRCUIT,DI:3/8 LINE DCDR	01295	SN74LS138NP3
A15U3140	156-0479-02		MICROCIRCUIT,DI:QUAD 2-INP ORGATE	01295	SN74LS32NP3
A15U3150	156-0388-03		MICROCIRCUIT,DI:DUAL D FLIP-FLOP	07263	74LS74A
A15U4100	156-0382-02		MICROCIRCUIT,DI:QUAD 2-INP NAND GATE	01295	SN74LS00
A15U4010	156-1613-00		MICROCIRCUIT,DI:SRAM,4096 X 1,W/3 STATE	34649	D2147HL-3
A15U4020	156-1613-00		MICROCIRCUIT,DI:SRAM,4096 X 1,W/3 STATE	34649	D2147HL-3
A15U4030	156-1613-00		MICROCIRCUIT,DI:SRAM,4096 X 1,W/3 STATE	34649	D2147HL-3
A15U4040	156-1613-00		MICROCIRCUIT,DI:SRAM,4096 X 1,W/3 STATE	34649	D2147HL-3
A15U4050	156-0693-02		MICROCIRCUIT,DI:DECODER/DEMUTIPLEXER	27014	DM74S139
A15U4060	156-0985-01		MICROCIRCUIT,DI:DUAL 5 INPUT NOR GATE,SCRN	04713	SN74LS260
A15U4070	156-0471-02		MICROCIRCUIT,DI:DUAL 4/1 LINEDATA SEL	01295	SN74LS253NP3
A15U4080	156-0985-01		MICROCIRCUIT,DI:DUAL 5 INPUT NOR GATE,SCRN	04713	SN74LS260
A15U4090	156-0471-02		MICROCIRCUIT,DI:DUAL 4/1 LINEDATA SEL	01295	SN74LS253NP3

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A15U4110	156-0645-02		MICROCIRCUIT,DI:HEX INV ST NANOS-NAND	01295	SN74LS14NP3
A15U4120	156-0382-02		MICROCIRCUIT,DI:QUAD 2-INP NAND GATE	01295	SN74LS00
A15U4130	156-1393-01		MICROCIRCUIT,DI:QUAD 2 INPUT NAND BFR,SCRN	01295	SN74S38N3/J4
A15U4140	156-0480-02		MICROCIRCUIT,DI:QUAD 2 INP & GATE	01295	SN74LS08NP3
A15U4150	156-0464-02		MICROCIRCUIT,DI:DUAL 4 INP NAND GATE	01295	SN74LS20
A15U4160	156-0388-03		MICROCIRCUIT,DI:DUAL D FLIP-FLOP	07263	74LS74A
A15U5100	156-0645-02		MICROCIRCUIT,DI:HEX INV ST NANOS-NAND	01295	SN74LS14NP3
A15U5020	156-0985-01		MICROCIRCUIT,DI:DUAL 5 INPUT NOR GATE,SCRN	04713	SN74LS260
A15U5030	156-0386-02		MICROCIRCUIT,DI:TRIPLE 3 INP NAND GATE	01295	SN74LS10NP3
A15U5040	156-0383-02		MICROCIRCUIT,DI:QUAD 2-INP NOR GATE	01295	SN74LS02
A15U5050	156-0985-01		MICROCIRCUIT,DI:DUAL 5 INPUT NOR GATE,SCRN	04713	SN74LS260
A15U5060	156-0914-02		MICROCIRCUIT,DI:OCT ST BFR W/3 STATE OUT	01295	SN74LS240
A15U5070	156-0914-02		MICROCIRCUIT,DI:OCT ST BFR W/3 STATE OUT	01295	SN74LS240
A15U5080	156-0865-02		MICROCIRCUIT,DI:OCTAL D-TYPE FF W/CLEAR	01295	SN74LS273NP3
A15U5090	156-0865-02		MICROCIRCUIT,DI:OCTAL D-TYPE FF W/CLEAR	01295	SN74LS273NP3
A15U5110	156-0403-02		MICROCIRCUIT,DI:HEX INVERTER,SCRN	01295	SN74S05
A15U5120	156-0383-02		MICROCIRCUIT,DI:QUAD 2-INP NOR GATE	01295	SN74LS02
A15U5130	156-1059-01		MICROCIRCUIT,DI:DUAL J-K EDGETRIGGERED	01295	SN74LS109A
A15U5140	156-0385-02		MICROCIRCUIT,DI:HEX INVERTER	01295	SN74LS04
A15U5150	156-0844-02		MICROCIRCUIT,DI:SYN 4 BIT CNTR,SCRN	01295	SN74LS161A
A15U5160	156-0718-03		MICROCIRCUIT,DI:TRIPLE 3-INP NOR GATE	01295	SN74LS27

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Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A20	-----		CKT BOARD ASSY:CABLE TERMINATION		
A20C1009	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A20C2039	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A20F2010	159-0021-00		FUSE,CARTRIDGE:3AG,2A,250V,FAST-BLOW	71400	AGC 2
A20F2020	159-0021-00		FUSE,CARTRIDGE:3AG,2A,250V,FAST-BLOW	71400	AGC 2
A20F3010	159-0025-00		FUSE,CARTRIDGE:3AG,0.5A,250V,FAST-BLOW	71400	AGC 1/2
A20R1041	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A20R1043	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A20RP2030	307-0658-00		RES NTWK,FXD,FI:14,220 OHM,14,330 OHM,2%	01121	316E221331
A20U1010	156-1179-01		MICROCIRCUIT,DI:OCTAL BFR,W/3STATE OUT	01295	SN74S241 JP3
A20U2040	156-1179-01		MICROCIRCUIT,DI:OCTAL BFR,W/3STATE OUT	01295	SN74S241 JP3
A30	-----		CKT BOARD ASSY:BUFFER		
A30C1011	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C1041	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C4011	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C4031	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C5031	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C5051	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C6011	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C6031	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C6051	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C7011	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C7032	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C7031	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C7041	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C8021	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C8031	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C8041	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C9013	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C9041	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C9051	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30C9052	290-0782-00		CAP.,FXD,ELCTLT:4.7UF,+75-10%,35V	55680	35ULA4R7V-T
A30C9091	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A30CR7031	152-0322-00		SEMICONV DEVICE:SILICON,15V,HOT CARRIER	50434	5082-2672
A30Q8011	151-0427-00		TRANSISTOR:SILICON,NPN	80009	151-0427-00
A30Q9011	151-1103-00		TRANSISTOR:SILICON,FE,N-CHANNEL	18324	SD210EE
A30R1031	315-0471-00		RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A30R1032	315-0331-00		RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
A30R1033	315-0221-00		RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A30R2031	315-0471-00		RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A30R2032	315-0471-00		RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A30R2033	315-0471-00		RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A30R2051	315-0331-00		RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
A30R2052	315-0221-00		RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A30R4051	315-0331-00		RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
A30R4052	315-0221-00		RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A30R7011	308-0620-00		RES.,FXD,WW:27.0 OHM,1%,3W	80009	308-0620-00
A30R7012	315-0271-00		RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
A30R7013	315-0391-00		RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
A30R7021	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A30R7022	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A30R7023	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A30R7031	315-0472-00		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A30R7032	315-0472-00		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725

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Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A30R7033	315-0472-00		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A30R7034	315-0104-00		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A30R7041	315-0331-00		RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
A30R7042	315-0221-00		RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A30R7043	315-0331-00		RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
A30R7044	315-0221-00		RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A30R7045	315-0472-00		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A30R8011	315-0181-00		RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
A30R8013	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A30R8014	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A30R8015	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A30R8016	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A30R8017	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A30R8018	315-0271-00		RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
A30R8019	315-0391-00		RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
A30R9011	315-0392-00		RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
A30R9012	315-0100-00		RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A30R9013	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A30R9031	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A30R9041	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A30R9042	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A30U1010	156-1179-01		MICROCIRCUIT,DI:OCTAL BFR,W/3STATE OUT	01295	SN74S241 JP3
A30U1020	156-1179-01		MICROCIRCUIT,DI:OCTAL BFR,W/3STATE OUT	01295	SN74S241 JP3
A30U2040	156-1111-02		MICROCIRCUIT,DI:OCTAL BUS TRANSCEIVERS	80009	156-1111-02
A30U2050	156-1179-01		MICROCIRCUIT,DI:OCTAL BFR,W/3STATE OUT	01295	SN74S241 JP3
A30U4010	156-1111-02		MICROCIRCUIT,DI:OCTAL BUS TRANSCEIVERS	80009	156-1111-02
A30U4020	156-1111-02		MICROCIRCUIT,DI:OCTAL BUS TRANSCEIVERS	80009	156-1111-02
A30U4030	156-0718-03		MICROCIRCUIT,DI:TRIPLE 3-INP NOR GATE	01295	SN74LS27
A30U4040	156-0645-02		MICROCIRCUIT,DI:HEX INV ST NANOS-NAND	01295	SN74LS14NP3
A30U4050	156-1111-02		MICROCIRCUIT,DI:OCTAL BUS TRANSCEIVERS	80009	156-1111-02
A30U5010	156-1179-01		MICROCIRCUIT,DI:OCTAL BFR,W/3STATE OUT	01295	SN74S241 JP3
A30U5020	156-1179-01		MICROCIRCUIT,DI:OCTAL BFR,W/3STATE OUT	01295	SN74S241 JP3
A30U5030	156-0323-02		MICROCIRCUIT,DI:HEX INVERTER,BURN-IN	01295	SN74S04
A30U5040	156-0703-02		MICROCIRCUIT,DI:4-2-3-2 INPUT& OR GATE	07263	74S64
A30U5050	156-0321-02		MICROCIRCUIT,DI:TRIPLE 3 INP NAND GATE	01295	SN74S10
A30U6010	156-0180-04		MICROCIRCUIT,DI:QUAD 2 INP NAND GATE	01295	SN74S00NP3
A30U6020	156-1179-01		MICROCIRCUIT,DI:OCTAL BFR,W/3STATE OUT	01295	SN74S241 JP3
A30U6030	156-0966-01		MICROCIRCUIT,DI:DUAL 5 INP NOR GATES	80009	156-0966-01
A30U6040	156-0703-02		MICROCIRCUIT,DI:4-2-3-2 INPUT& OR GATE	07263	74S64
A30U6050	156-1179-01		MICROCIRCUIT,DI:OCTAL BFR,W/3STATE OUT	01295	SN74S241 JP3
A30U7010	156-1617-00		MICROCIRCUIT,DI:HEX 2-INP NORDVR,SCRN	01295	SN74AS804J1N
A30U7020	156-1179-01		MICROCIRCUIT,DI:OCTAL BFR,W/3STATE OUT	01295	SN74S241 JP3
A30U7030	156-0418-01		MICROCIRCUIT,DI:8 INPUT NAND GATE,SCRN	01295	SN74S30
A30U7040	156-0413-02		MICROCIRCUIT,DI:QUAD 2-INP SCHMITT TRIG	80009	156-0413-02
A30U7050	156-1179-01		MICROCIRCUIT,DI:OCTAL BFR,W/3STATE OUT	01295	SN74S241 JP3
A30U8010	156-0690-03		MICROCIRCUIT,DI:QUAD 2 INP NOR GATE,BURN IN	01295	SN74S02
A30U8020	156-0690-03		MICROCIRCUIT,DI:QUAD 2 INP NOR GATE,BURN IN	01295	SN74S02
A30U8030	156-0180-04		MICROCIRCUIT,DI:QUAD 2 INP NAND GATE	01295	SN74S00NP3
A30U8040	156-1179-01		MICROCIRCUIT,DI:OCTAL BFR,W/3STATE OUT	01295	SN74S241 JP3
A30U8050	156-1179-01		MICROCIRCUIT,DI:OCTAL BFR,W/3STATE OUT	01295	SN74S241 JP3
A30U9010	156-1058-01		MICROCIRCUIT,DI:OCTAL ST BFR W/3 STATE OUT	01295	SN74S240JP4
A30U9020	156-0323-02		MICROCIRCUIT,DI:HEX INVERTER,BURN-IN	01295	SN74S04
A30U9030	156-0303-01		MICROCIRCUIT,DI:QUAD 2 INP NAND GATE	01295	SN74S03NP3
A30U9040	156-0690-03		MICROCIRCUIT,DI:QUAD 2 INP NOR GATE,BURN IN	01295	SN74S02
A30U9050	156-0323-02		MICROCIRCUIT,DI:HEX INVERTER,BURN-IN	01295	SN74S04

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Component No.	Tektronix Part No.	Serial/Model No. Eff . Dscont	Name & Description	Mfr Code	Mfr Part Number
A35	-----		CKT BOARD ASSY:68000 MOBILE		
A35C1011	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A35C1019	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A35C1041	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A35C2040	290-0782-00		CAP.,FXD,ELCTLT:4.7UF,+75-10%,35V	55680	35ULA4R7V-T
A35C2041	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A35DL1010	119-1446-00		DELAY LINE,ELEC:25NS,TAPPED,8PIN	90095	TTLDL025
A35DL1020	119-1448-00		DELAY LINE,ELEC:200NS,TAPPED,14 PIN	90095	TTLDL200
A35DL1040	119-1407-00		DELAY LINE,ELEC:100NS,TAPPED,14 PIN	32440	TTLDM100
A35R1016	315-0272-00		RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
A35R2042	315-0472-00		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A35RP1009	307-0445-00		RES NTWK,FXD,FI:4.7K OHM,20%,(9) RES	91637	MSP10A01-472M
A35RP1019	307-0446-00		RES,NTWK,FXD FI:10K OHM,20%,(9) RES	91637	MSP10A01-103M
A35U1030	156-0382-02		MICROCIRCUIT,DI:QUAD 2-INP NAND GATE	01295	SN74LS00
A35U2020	156-1445-00		MICROCIRCUIT,DI:16-BIT MICROPROCESSOR	04713	MC680001
A35U2040	156-0718-03		MICROCIRCUIT,DI:TRIPLE 3-INP NOR GATE	01295	SN74LS27

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A40	-----		CKT BOARD ASSY:68000 CONTROL		
A40C1009	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C1033	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C1049	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C1056	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C2009	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C2029	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C2039	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C2049	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C2056	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C3009	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C3029	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C3039	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C3049	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C4009	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C4029	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C4039	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C4049	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C5009	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C5029	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C5039	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C5049	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C6009	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C6029	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C6039	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C6049	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C7009	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C7029	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C7039	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C7049	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C8009	290-0782-00		CAP.,FXD,ELCTLT:4.7UF,+75-10%,35V	55680	35ULA4R7V-T
A40C8049	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40C9059	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A40R1001	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R2031	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R2057	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R2058	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R2059	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R3031	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R5002	315-0471-00		RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A40R5003	315-0471-00		RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A40R5004	315-0471-00		RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A40R6031	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R6038	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R6047	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R7001	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R7002	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R7003	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R7004	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R7031	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R7038	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R8024	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A40R8025	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A40R8027	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A40U1010	156-0690-03		MICROCIRCUIT,DI:QUAD 2 INP NOR GATE,BURN IN	01295	SN74S02
A40U1020	156-0180-04		MICROCIRCUIT,DI:QUAD 2 INP NAND GATE	01295	SN74S00NP3
A40U1040	156-0464-02		MICROCIRCUIT,DI:DUAL 4 INP NAND GATE	01295	SN74LS20

Replaceable Electrical Parts—68000 E.P. Service

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A40U1050	156-0392-03		MICROCIRCUIT,DI:QUAD LATCH W/CLEAR	01295	SN74S175NP3
A40U2000	156-0388-03		MICROCIRCUIT,DI:DUAL D FLIP-FLOP	07263	74LS74A
A40U2010	156-0385-02		MICROCIRCUIT,DI:HEX INVERTER	01295	SN74LS04
A40U2020	156-0321-02		MICROCIRCUIT,DI:TRIPLE 3 INP NAND GATE	01295	SN74S10
A40U2030	156-0180-04		MICROCIRCUIT,DI:QUAD 2 INP NAND GATE	01295	SN74S00NP3
A40U2040	156-0480-02		MICROCIRCUIT,DI:QUAD 2 INP & GATE	01295	SN74LS08NP3
A40U2050	156-0118-03		MICROCIRCUIT,DI:1 DUAL J-K FF,BURN-IN	01295	SN74S112JP3
A40U3000	156-0914-02		MICROCIRCUIT,DI:OCT ST BFR W/3 STATE OUT	01295	SN74LS240
A40U3010	156-0383-02		MICROCIRCUIT,DI:QUAD 2-INP NOR GATE	01295	SN74LS02
A40U3020	156-0718-03		MICROCIRCUIT,DI:TRIPLE 3-INP NOR GATE	01295	SN74LS27
A40U3030	156-0388-03		MICROCIRCUIT,DI:DUAL D FLIP-FLOP	07263	74LS74A
A40U3040	156-0118-03		MICROCIRCUIT,DI:1 DUAL J-K FF,BURN-IN	01295	SN74S112JP3
A40U4010	156-0718-03		MICROCIRCUIT,DI:TRIPLE 3-INP NOR GATE	01295	SN74LS27
A40U4020	156-1619-00		MICROCIRCUIT,DI:QUAD BUS BUFFER,W/3 STATE	04713	SN74LS126
A40U4030	156-0321-02		MICROCIRCUIT,DI:TRIPLE 3 INP NAND GATE	01295	SN74S10
A40U4040	156-0323-02		MICROCIRCUIT,DI:HEX INVERTER,BURN-IN	01295	SN74S04
A40U5010	156-0392-03		MICROCIRCUIT,DI:QUAD LATCH W/CLEAR	01295	SN74S175NP3
A40U5020	156-0718-03		MICROCIRCUIT,DI:TRIPLE 3-INP NOR GATE	01295	SN74LS27
A40U5030	156-0321-02		MICROCIRCUIT,DI:TRIPLE 3 INP NAND GATE	01295	SN74S10
A40U5040	156-0383-02		MICROCIRCUIT,DI:QUAD 2-INP NOR GATE	01295	SN74LS02
A40U6010	156-0914-02		MICROCIRCUIT,DI:OCT ST BFR W/3 STATE OUT	01295	SN74LS240
A40U6020	156-1041-02		MICROCIRCUIT,DI:4 BIT MAGNITUDE COMPARATOR	01295	SN74S85JP4
A40U6030	156-0331-03		MICROCIRCUIT,DI:DUAL D TYPE POSITIVE EDGE	80009	156-0331-03
A40U6040	156-0804-02		MICROCIRCUIT,DI:QUADRUPLE S-RLATCH,SCRN	01295	SN74LS279NP3
A40U7010	156-1179-01		MICROCIRCUIT,DI:OCTAL BFR,W/3STATE OUT	01295	SN74S241 JP3
A40U7020	156-0392-03		MICROCIRCUIT,DI:QUAD LATCH W/CLEAR	01295	SN74S175NP3
A40U7030	156-0382-02		MICROCIRCUIT,DI:QUAD 2-INP NAND GATE	01295	SN74LS00
A40U7040	156-0479-02		MICROCIRCUIT,DI:QUAD 2-INP ORGATE	01295	SN74LS32NP3
A40U8040	156-0724-02		MICROCIRCUIT,DI:HEX INV W/OC OUT,BURN-IN	01295	SN74LS05

Replaceable Electrical Parts—68000 E.P. Service

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A50	-----		CKT BOARD ASSY:POWER SUPPLY		
A50C1031	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A50C1033	283-0421-00		CAP.,FXD,CER DI:0.1UF,+80-20%,50V	04222	DG015E104Z
A50C1041	290-0965-00		CAP.,FXD,ELCTLT:1200UF,+100-10%,20VDC	90201	VPR122N020J1L1J
A50C2012	283-0203-00		CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131N075E474M
A50C2015	283-0203-00		CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131N075E474M
A50C2032	283-0005-00		CAP.,FXD,CER DI:0.01UF,+100-0%,250V	72982	8131N300Z5U0103P
A50C3032	283-0197-00		CAP.,FXD,CER DI:470PF,5%,100V	72982	8121N075C0G0471J
A50C5031	290-0965-00		CAP.,FXD,ELCTLT:1200UF,+100-10%,20VDC	90201	VPR122N020J1L1J
A50C6011	290-0746-00		CAP.,FXD,ELCTLT:47UF,+50-10%,16V	55680	16U-47V-T
A50C6041	290-0965-00		CAP.,FXD,ELCTLT:1200UF,+100-10%,20VDC	90201	VPR122N020J1L1J
A50CR2014	152-0198-00		SEMICONV DEVICE:SILICON,200V,3A	03508	1N5624
A50CR2034	152-0638-00		SEMICONV DEVICE:ZENER,0.4W,7V,5%	80009	152-0638-00
A50CR3021	152-0582-00		SEMICONV DEVICE:SILICON,20V,3A	80009	152-0582-00
A50DS1021	150-1014-00		LAMP,LED:RED,50MA	07263	MV5054-1
A50DS2051	150-1064-00		LT EMITTING DIO:YELLOW,585NM,40 MA MAX	50522	MV5374C
A50DS3051	150-1064-00		LT EMITTING DIO:YELLOW,585NM,40 MA MAX	50522	MV5374C
A50DS3052	150-1064-00		LT EMITTING DIO:YELLOW,585NM,40 MA MAX	50522	MV5374C
A50DS4051	150-1064-00		LT EMITTING DIO:YELLOW,585NM,40 MA MAX	50522	MV5374C
A50DS5051	150-1064-00		LT EMITTING DIO:YELLOW,585NM,40 MA MAX	50522	MV5374C
A50DS6051	150-1064-00		LT EMITTING DIO:YELLOW,585NM,40 MA MAX	50522	MV5374C
A50L3021	108-0336-00		COIL,RF:100UH	80009	108-0336-00
A50L4033	108-0554-00		COIL,RF:5UH	80009	108-0554-00
A50L4041	108-0574-00		COIL,RF:30UH	80009	108-0574-00
A50Q2021	151-0302-00		TRANSISTOR:SILICON,NPN	07263	S038487
A50Q3011	151-0625-01		TRANSISTOR:D45H11,SCREENED	80009	151-0625-01
A50Q4021	151-0625-01		TRANSISTOR:D45H11,SCREENED	80009	151-0625-01
A50Q5011	151-0301-00		TRANSISTOR:SILICON,PNP	27014	2N2907A
A50Q5012	151-0302-00		TRANSISTOR:SILICON,NPN	07263	S038487
A50Q6021	151-0655-00		MICROCIRCUIT,DI:SILICON,NPN	01295	2N3725
A50R1011	311-1936-00		RES.,VAR,NONWIR:CKT BD,50 OHM,20%,0.5W	73138	MODEL 72X
A50R1012	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A50R1022	315-0152-00		RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
A50R1032	321-0277-00		RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
A50R1051	311-1236-00		RES.,VAR,NONWIR:250 OHM,10%,0.50W	73138	72-22-0
A50R1052	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A50R2011	315-0150-00		RES.,FXD,CMPSN:15 OHM,5%,0.25W	01121	CB1505
A50R2012	321-0135-00		RES.,FXD,FILM:249 OHM,1%,0.125W	91637	MFF1816G249R0F
A50R2021	315-0271-00		RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
A50R2022	315-0271-00		RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
A50R2033	321-0816-03		RES.,FXD,FILM:5K OHM,0.25%,0.125W	91637	MFF1816D50000C
A50R2034	315-0821-00		RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
A50R3062	315-0472-00		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A50R4011	315-0472-00		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A50R4012	315-0221-00		RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A50R4013	315-0151-00		RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
A50R4014	315-0621-00		RES.,FXD,CMPSN:620 OHM,5%,0.25W	01121	CB6215
A50R4015	303-0470-00		RES.,FXD,CMPSN:47 OHM,5%,1W	01121	GB4705
A50R4031	321-0034-00		RES.,FXD,FILM:22.1 OHM,1%,0.125W	91637	MFF1816G22R10F
A50R4032	315-0683-00		RES.,FXD,CMPSN:68K OHM,5%,0.25W	01121	CB6835
A50R4033	321-0123-00		RES.,FXD,FILM:187 OHM,1%,0.125W	91637	MFF1816G187R0F
A50R4041	321-0097-00		RES.,FXD,FILM:100 OHM,1%,0.125W	91637	MFF1816G100R0F
A50R4042	308-0710-00		RES.,FXD,WW:0.27 OHM,10%,1W	75042	BW20-R2700J
A50R4061	315-0331-00		RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
A50R4062	315-0331-00		RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
A50R4063	315-0331-00		RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
A50R4064	315-0331-00		RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315

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Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A50R5012	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A50R5013	315-0221-00		RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A50R5014	315-0472-00		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A50TP1011	214-0579-00		TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A50TP1061	214-0579-00		TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A50U2010	156-0991-00		MICROCIRCUIT,LI:VOLTAGE REGULATOR	04713	MC78L05ACP
A50U2030	156-1266-00		MICROCIRCUIT,LI:OVER VOLTAGE SENSING CKT	04713	SC77113LH
A50U3040	156-1161-00		MICROCIRCUIT,LI:VOLTAGE REGULATOR	27014	LM317T
A50U3060	156-0093-02		MICROCIRCUIT,DI:HEX INV BUFFER,BURN-IN	27014	DM8016
A50VR3022	152-0195-00		SEMICONV DEVICE:ZENER,0.4W,5.1V,5%	04713	SZ11755
A60	-----		PROBE ASSY:68000		
A60U10	155-0258-00		MICROCIRCUIT,DI:68000 EMULATOR PROBE	80009	155-0258-00

Section 12

DIAGRAMS

Standards

The following American National Standard Institute standards are used in the preparation of Tektronix, Inc. diagrams.

Graphic Symbols	ANSI Y32.2-1975
Logic Symbols	ANSI Y32.14-1973 (Positive logic. Logic symbols depict the logical function performed and may differ from the manufacturer's data.)
Abbreviations	ANSI Y1.1-1972
Drafting Practices	ANSI Y14.15-1966
Line Conventions And Lettering	ANSI Y14.2-1973
Letter Symbols	ANSI Y10.5-1968

Component Values

Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF).
Values less than one are in microfarads (μ F).

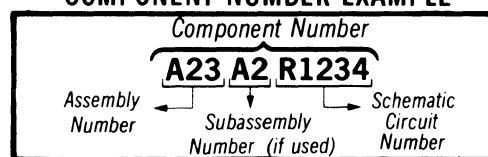
Resistors = Ohms (Ω)

The following special symbols may appear on the diagrams:

Assembly Numbers and Grid Coordinates

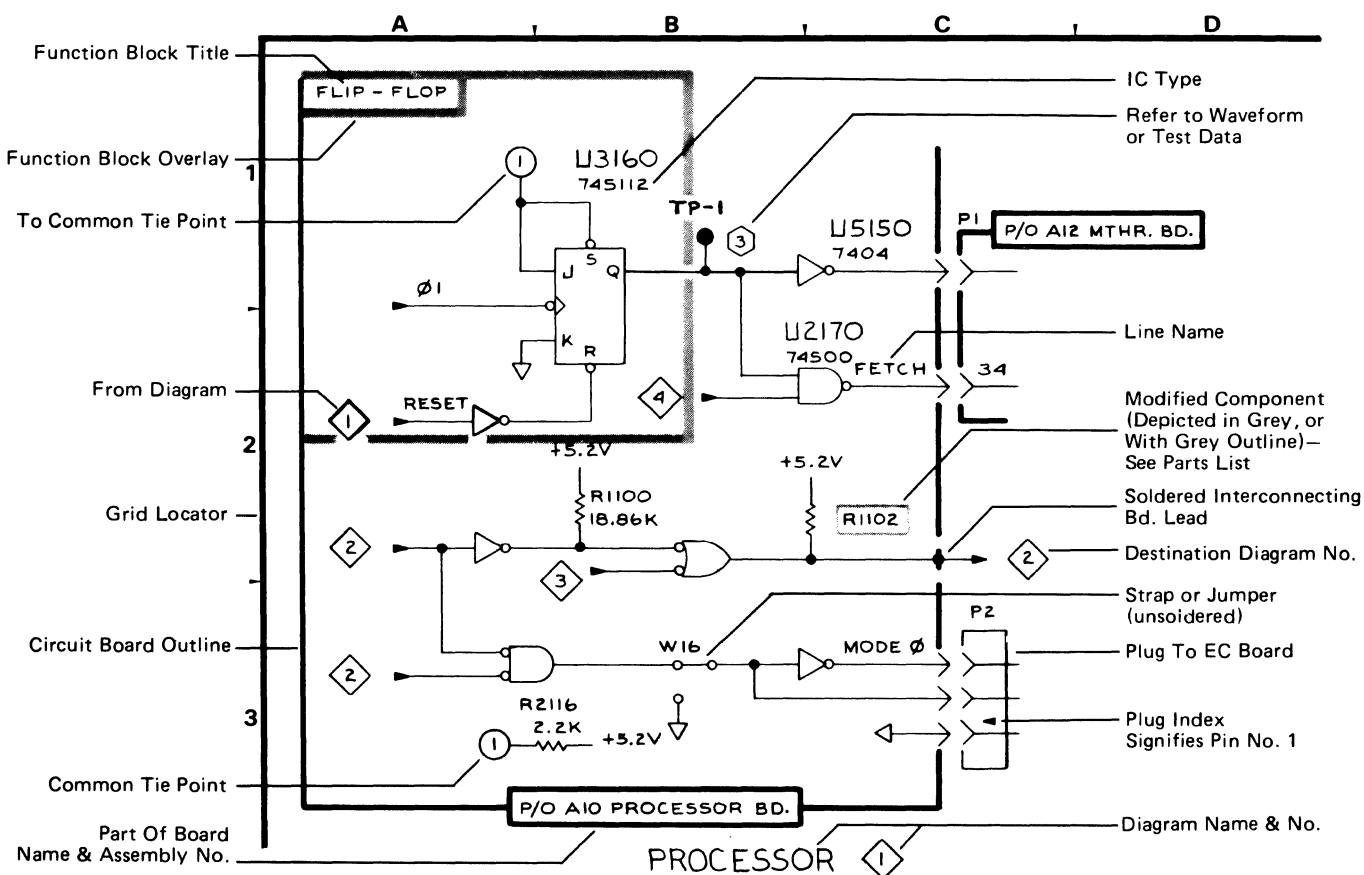
Each circuit board in the instrument is assigned an assembly number (e.g. A20). This number appears on the component location illustration, the schematics, and the component lookup table. The Replaceable Electrical Parts list also uses the number to list components by assembly. The following illustration shows an example of a component number in the Electrical Parts list.

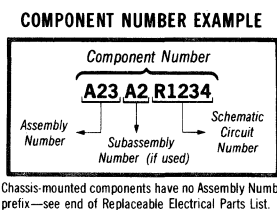
COMPONENT NUMBER EXAMPLE



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

Both the schematics and the component locator illustration have locating grids. A lookup table is assigned to each schematic. The lookup table gives the component location in both the associated schematic, and on the component locator illustration.



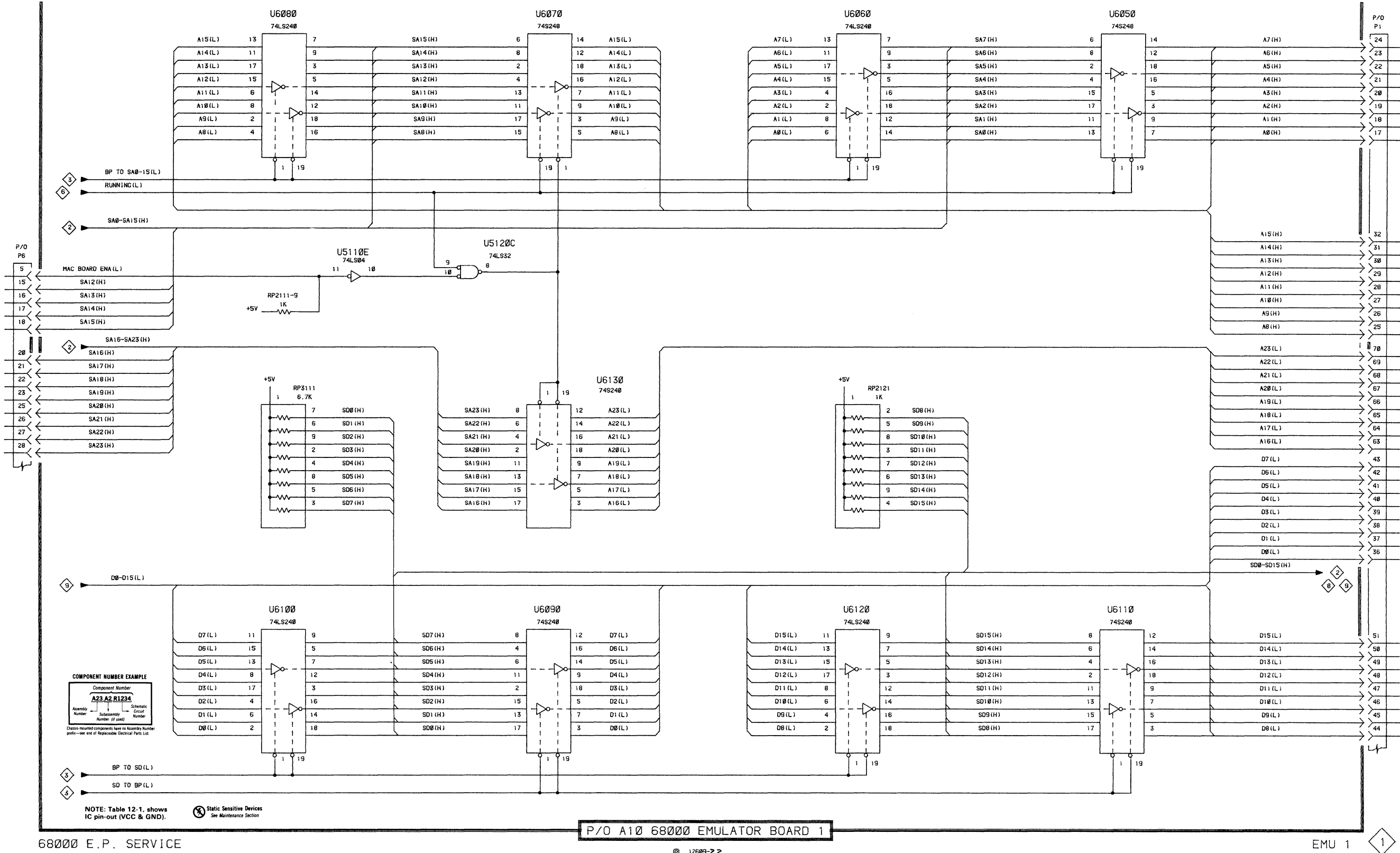


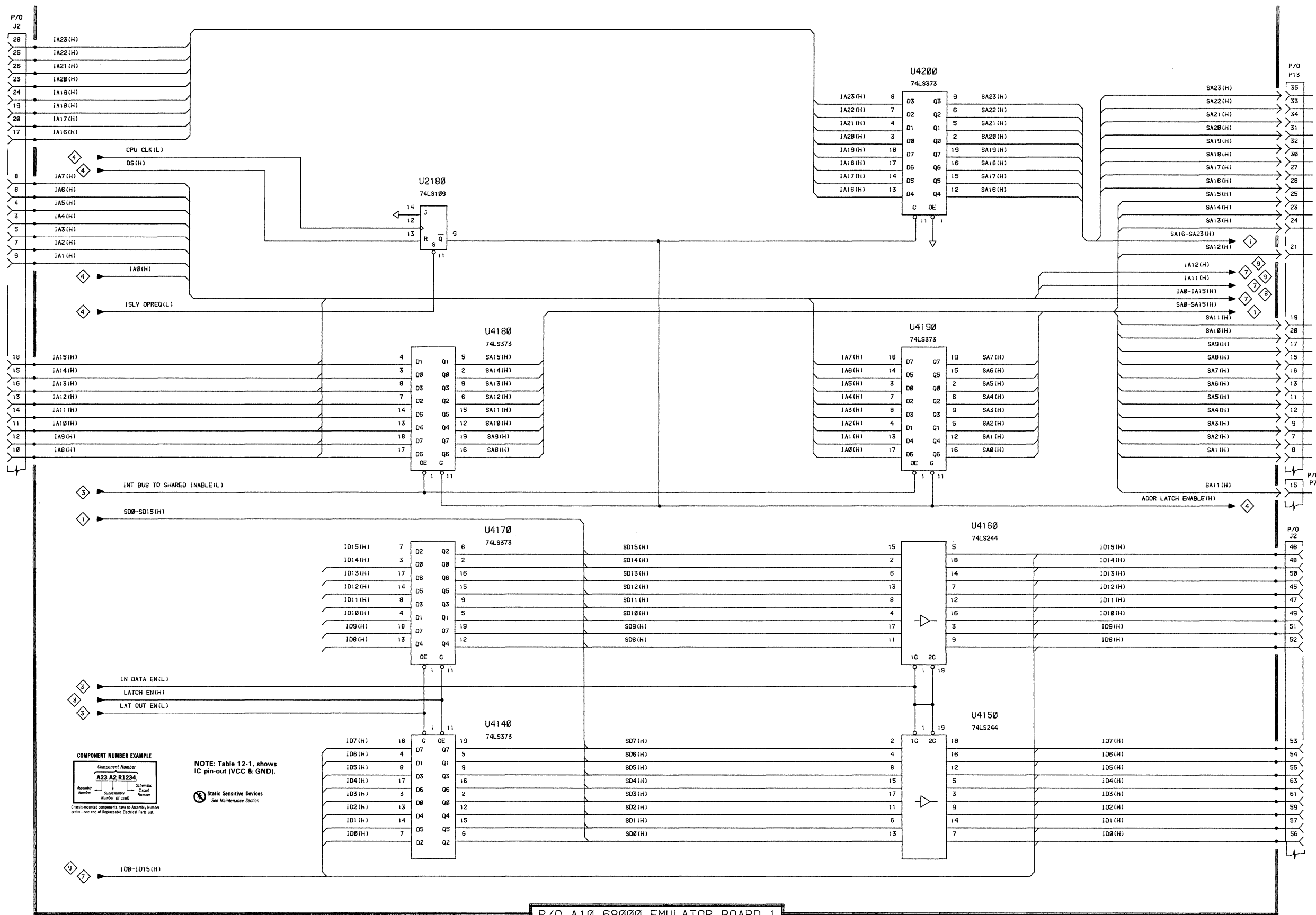
@

12609-15

Table 12-1
IC Pin Information

DEVICE	GND	VCC	DEVICE	GND	VCC
74S02	7	14	74LS244	10	20
74S10	7	14	74LS245	10	20
74S30-LS	7	14	74LS253	8	16
74S38	7	14	74LS257	8	16
74S64	7	14	74S260-LS	7	14
74S74-LS	7	14	74LS273	10	20
74S85	8	16	74LS274	10	20
74LS109	8	16	74LS279	8	16
74S112	8	16	74LS373	10	20
74LS138	8	16	74LS374	10	20
74S139	8	16	74LS390	8	16
74LS161	8	16	82LS181	8	16
74LS175	8	16	93L422	8	22
74S240-LS	10	20	2114	9	18
74S241	10	20	2147H	9	18





COMPONENT NUMBER EXAMPLE

Component Number
A23 A2 R1234

Assembly Number Subassembly Number (if used) Schematic Circuit Number

Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

NOTE: Table 12-1, shows IC pin-out (VCC & GND).

Static Sensitive Devices
See Maintenance Section

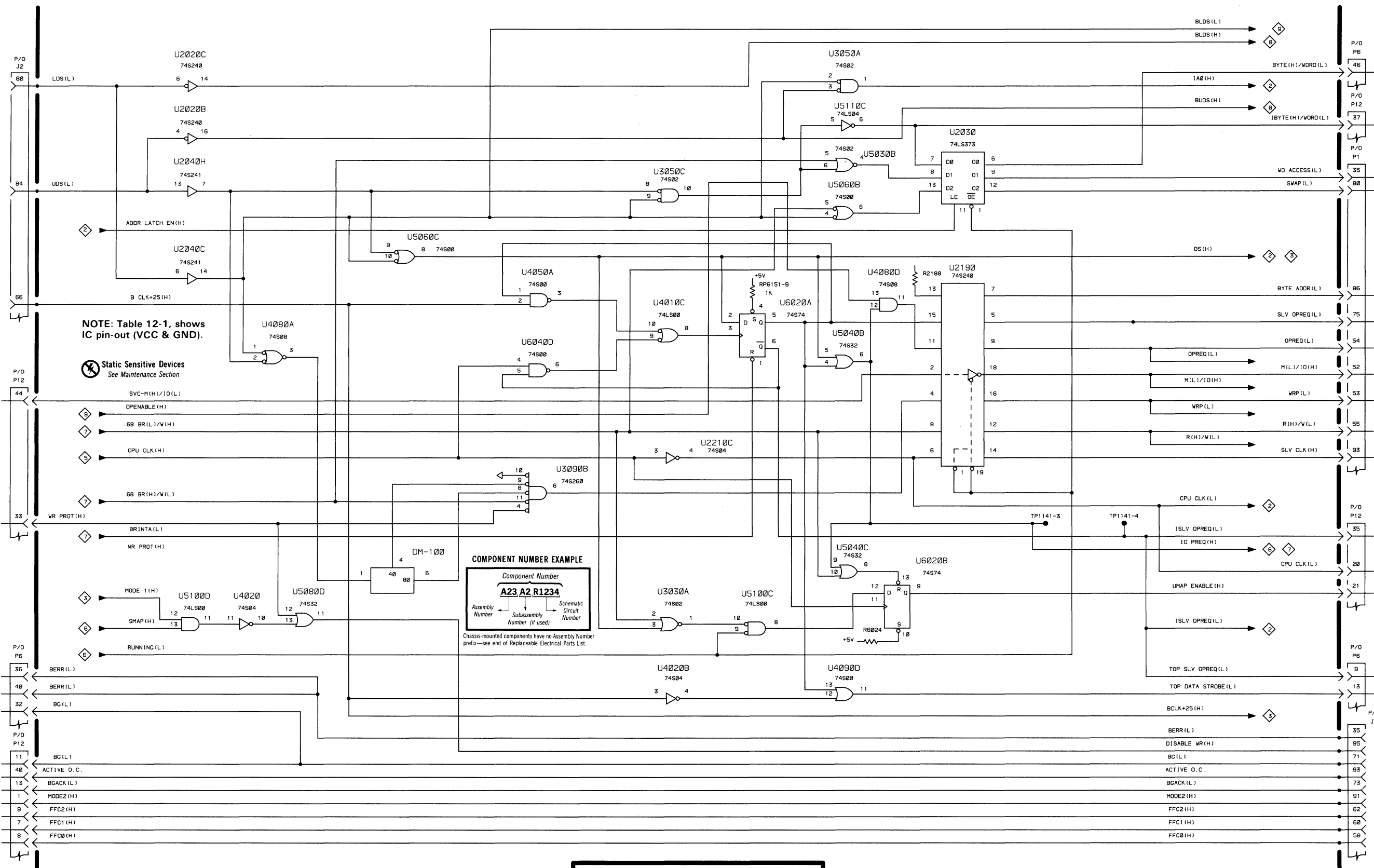
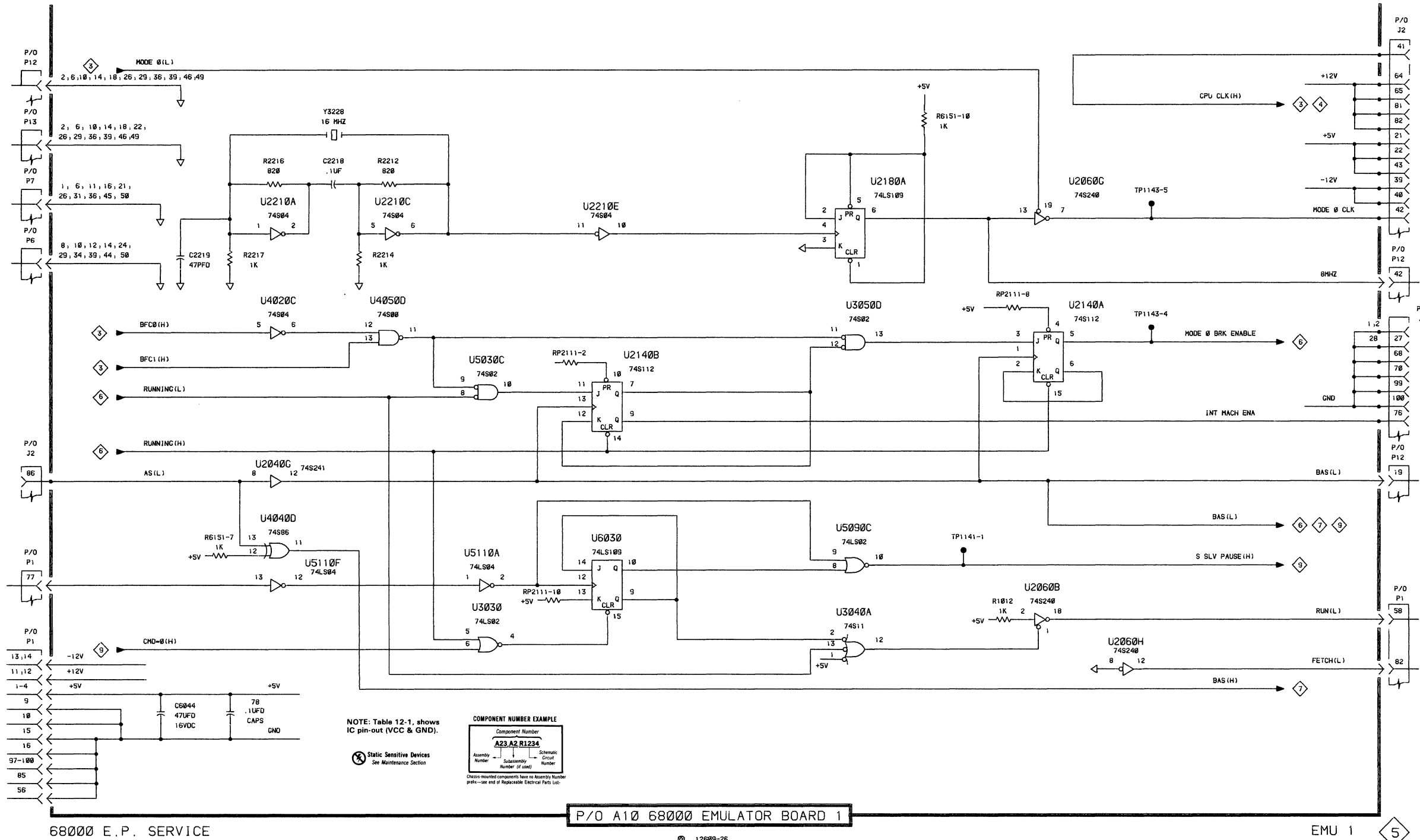
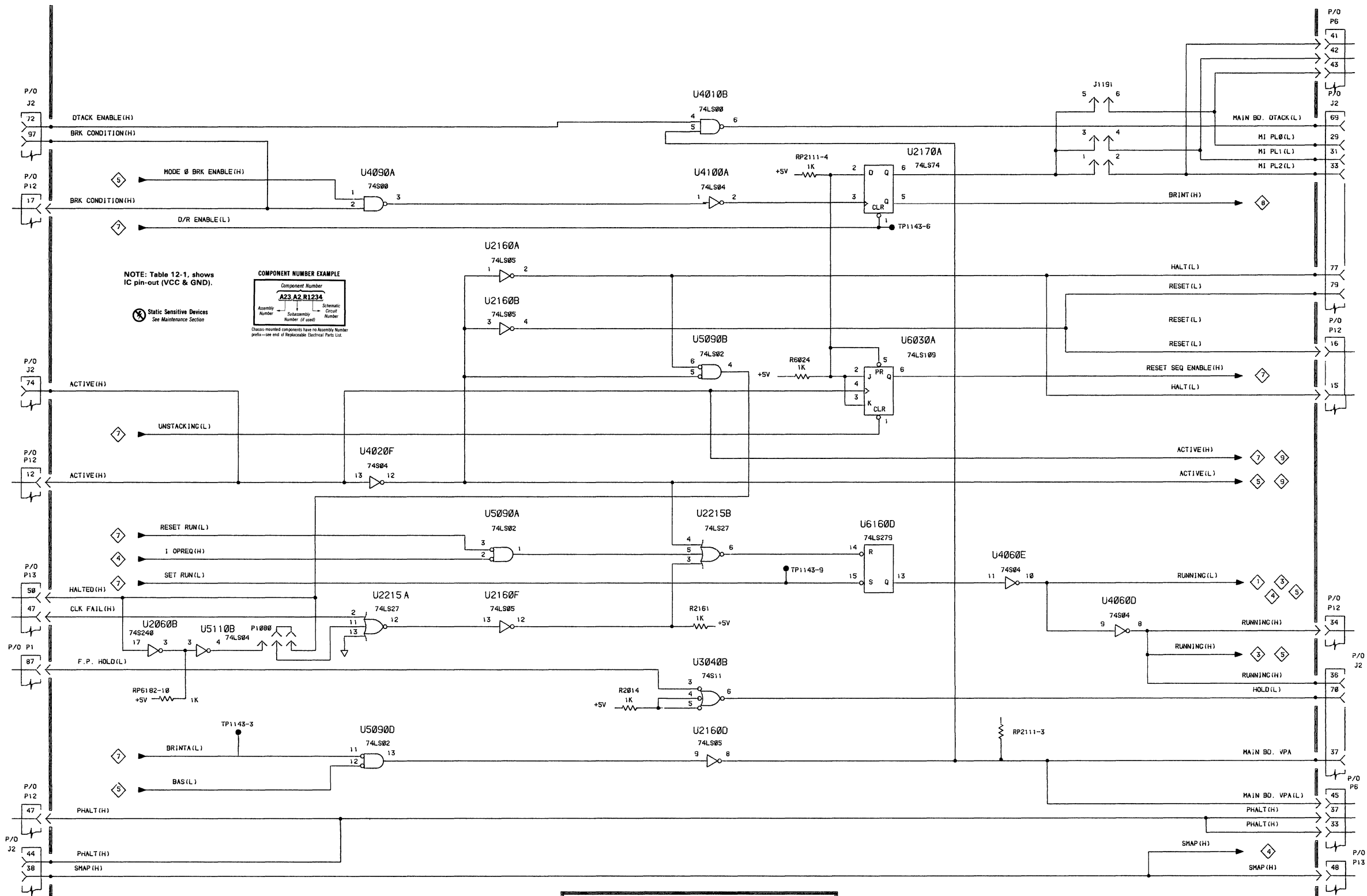
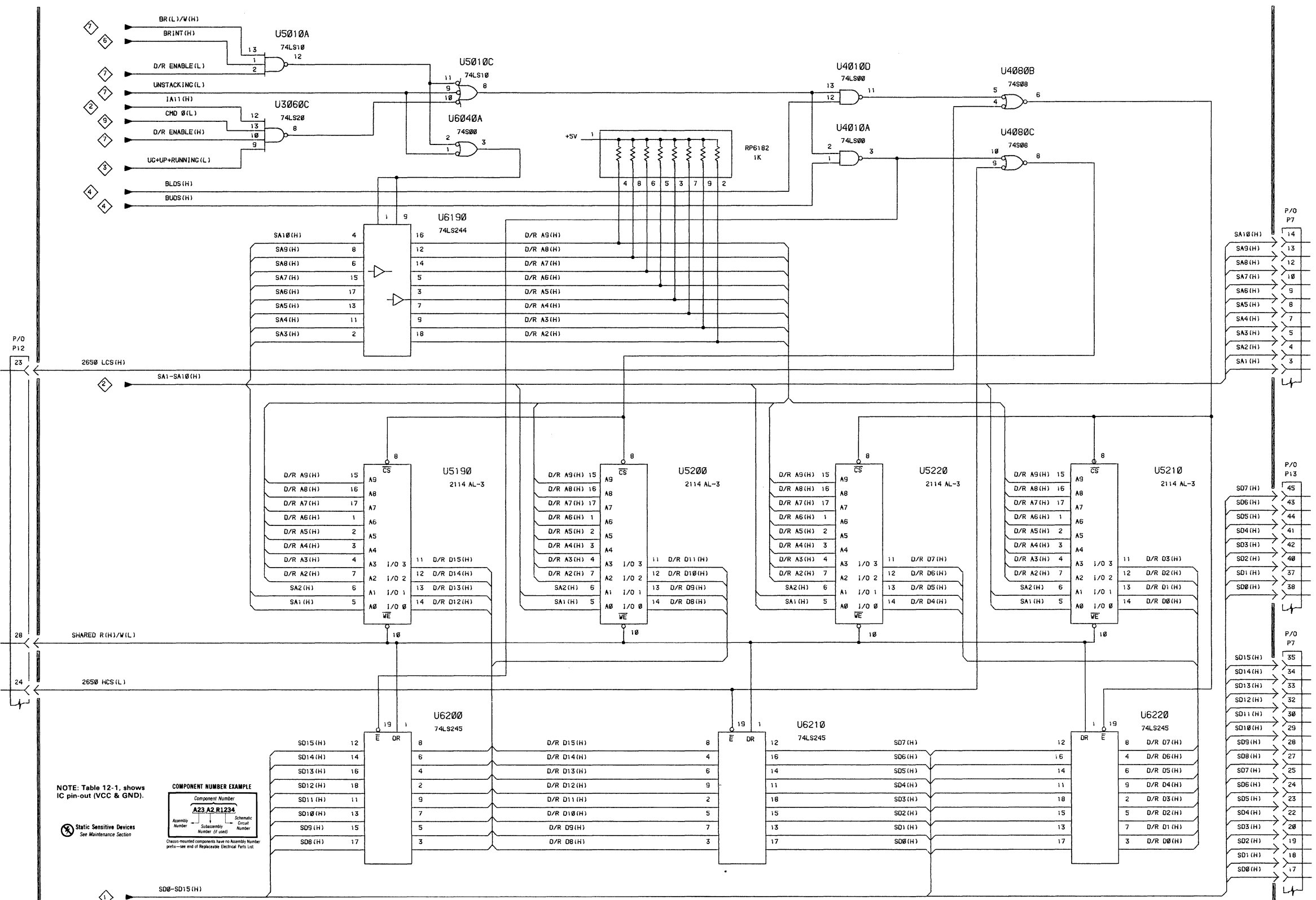


Table 12-2
0.1μF Decoupling Capacitors

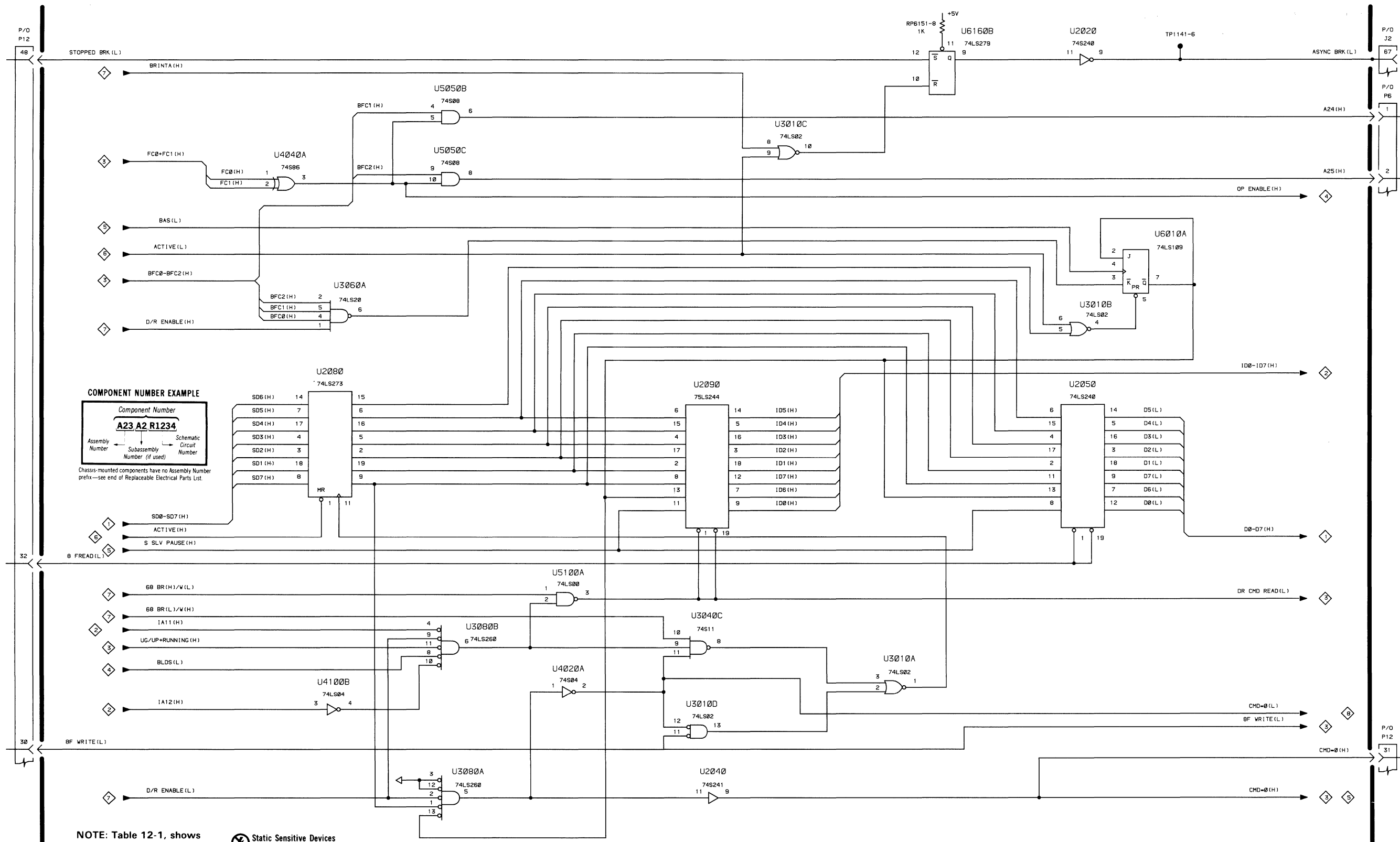
C2012	C4052	C5192
C2022	C4062	C5202
C2032	C4082	C5212
C2042	C4092	C5222
C2052	C4102	C6012
C2062	C4112	C6022
C2082	C4122	C6032
C2092	C4142	C6042
C2141	C4152	C6052
C2162	C4162	C6062
C2172	C4172	C6072
C2182	C4182	C6082
C2218	C4192	C6092
C2221	C4202	C6102
C3022	C4222	C6112
C3032	C5012	C6122
C3042	C5022	C6132
C3052	C5032	C6142
C3062	C5042	C6159
C3082	C5052	C6162
C3092	C5062	C6171
C3223	C5082	C6172
C4012	C5092	C6192
C4022	C5102	C6202
C4032	C5112	C6212
C4042	C5122	C6222







P/O A10 68000 EMULATOR BOARD 1



COMPONENT NUMBER EXAMPLE

Component Number
A23 A2 R1234
Assembly Number
Subassembly Number (if used)
Schematic Circuit Number

Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

NOTE: Table 12-1, shows IC pin-out (VCC & GND).

Static Sensitive Devices See Maintenance Section

P/O A10 68000 EMULATOR BOARD 1

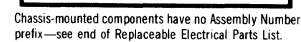


Fig. 12-2. A15 68000 EMU 2 Component Locations.

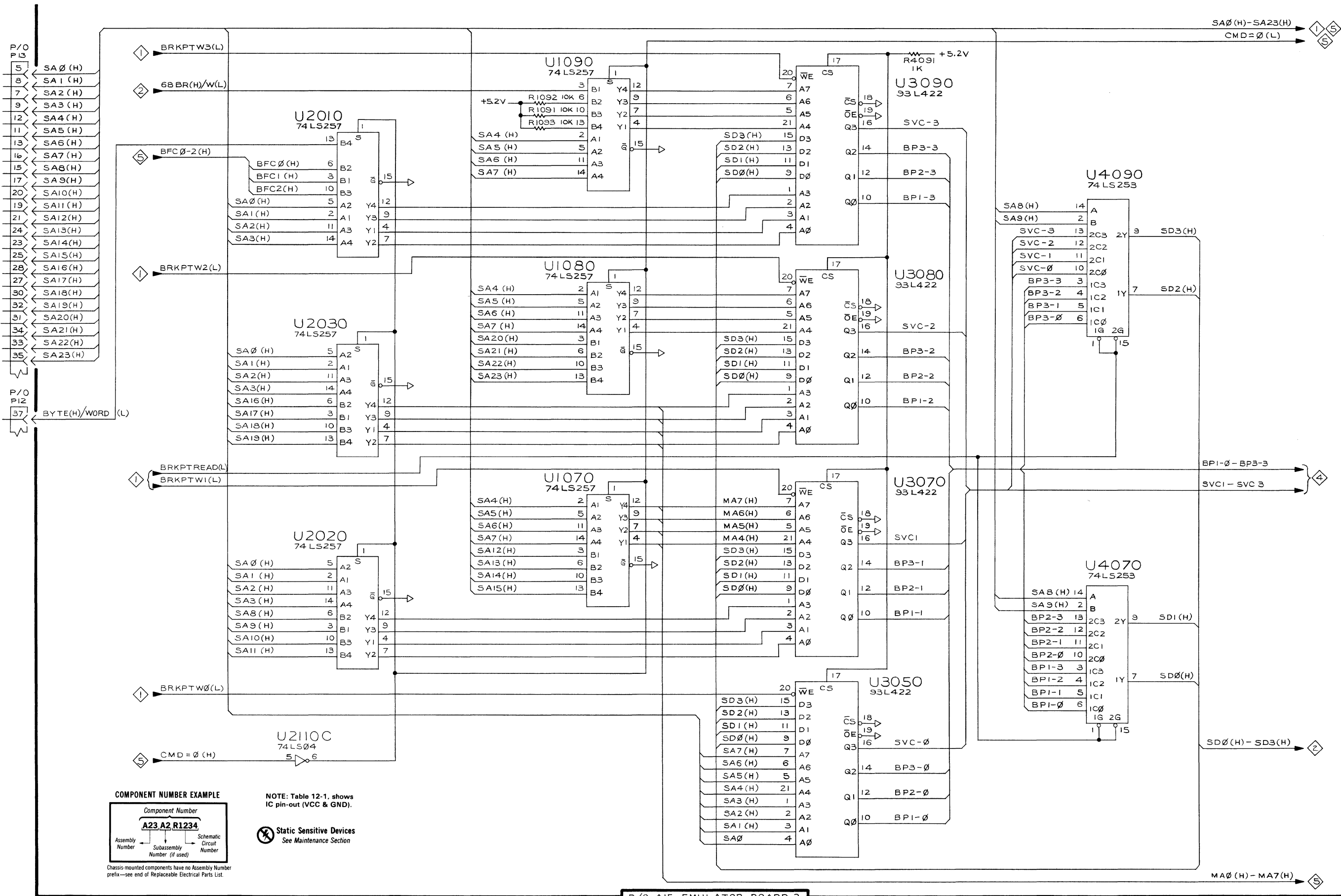
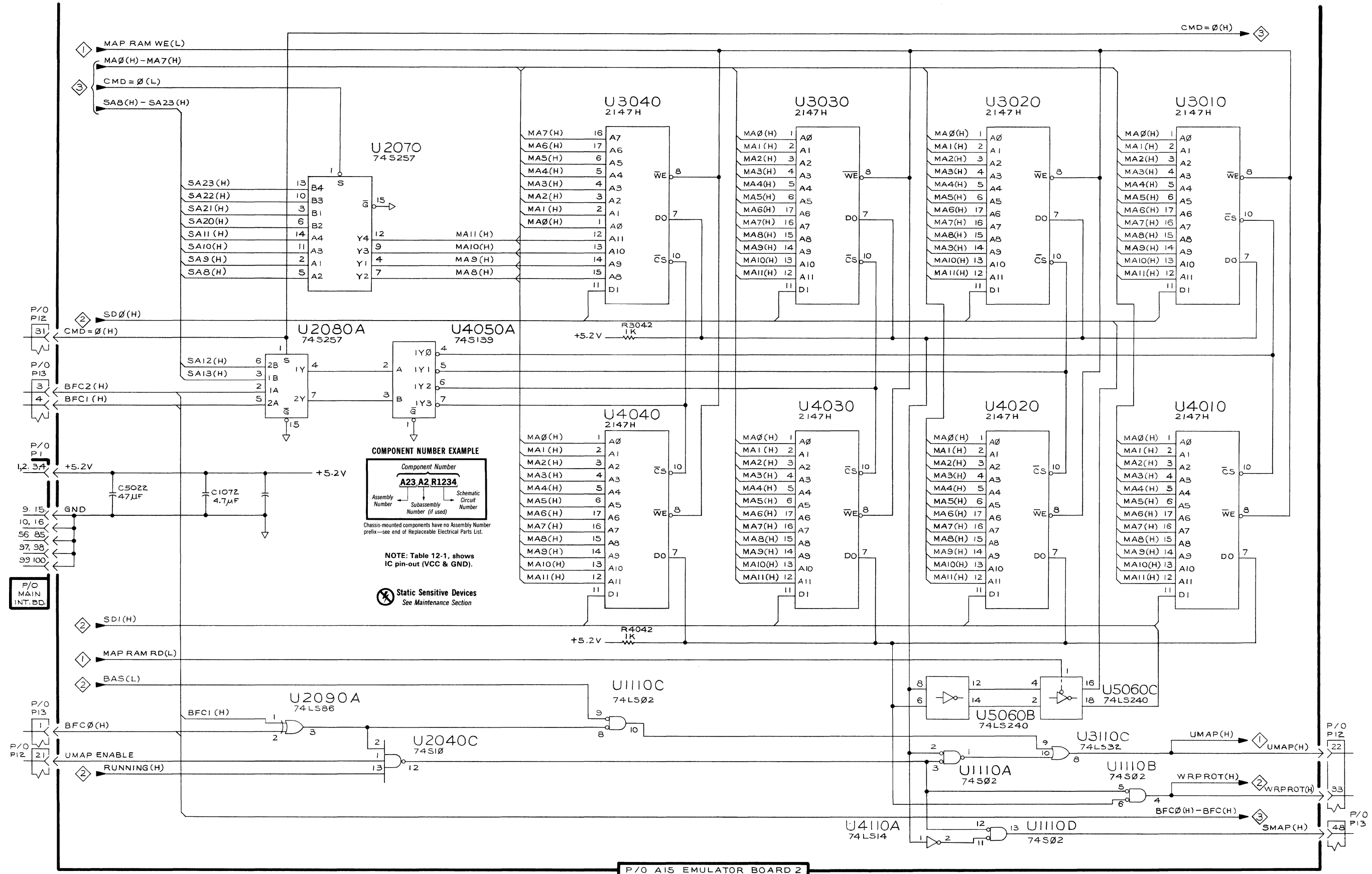
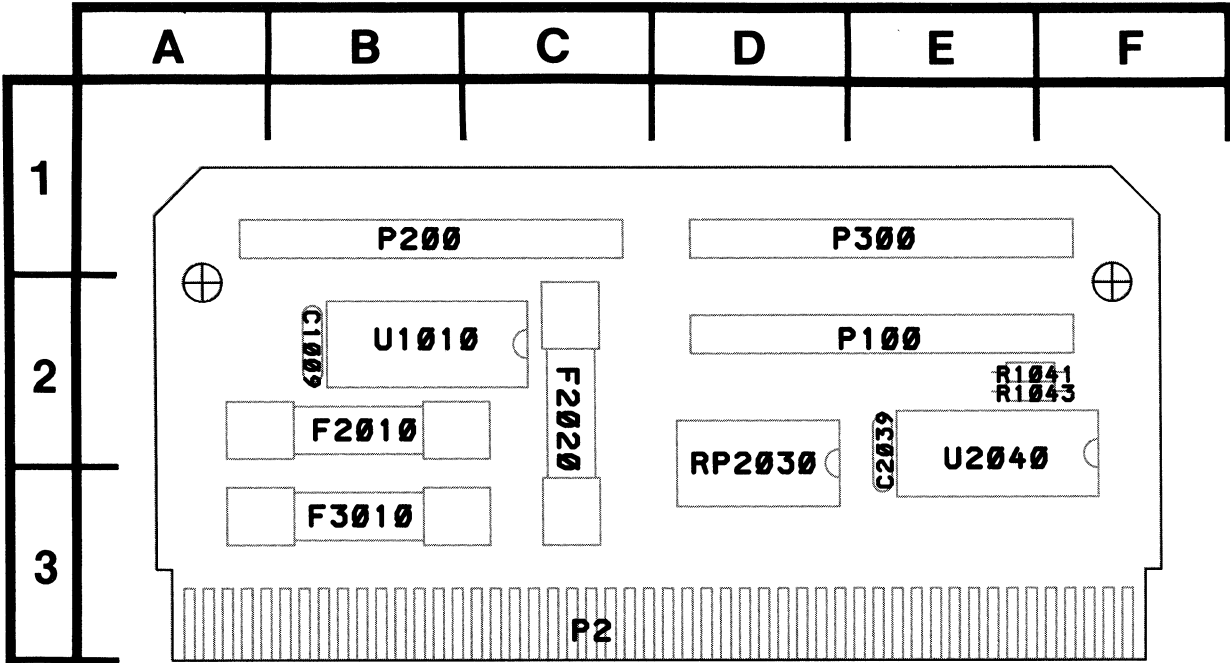


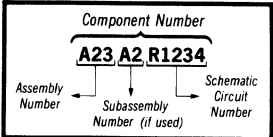
Table 12-3
0.1μF Decoupling Capacitors

C1071	C3101
C1081	C3121
C1101	C3141
C1111	C3161
C1121	C4011
C1141	C4021
C2011	C4031
C2031	C4041
C2051	C4061
C2091	C4081
C2102	C4101
C2121	C4121
C2141	C4142
C2161	C4161
C3011	C5021
C3021	C5041
C3031	C5072
C3041	C5092
C3051	C5101
C3071	C5112
C3081	C5121
C3091	C5141
	C5161





COMPONENT NUMBER EXAMPLE



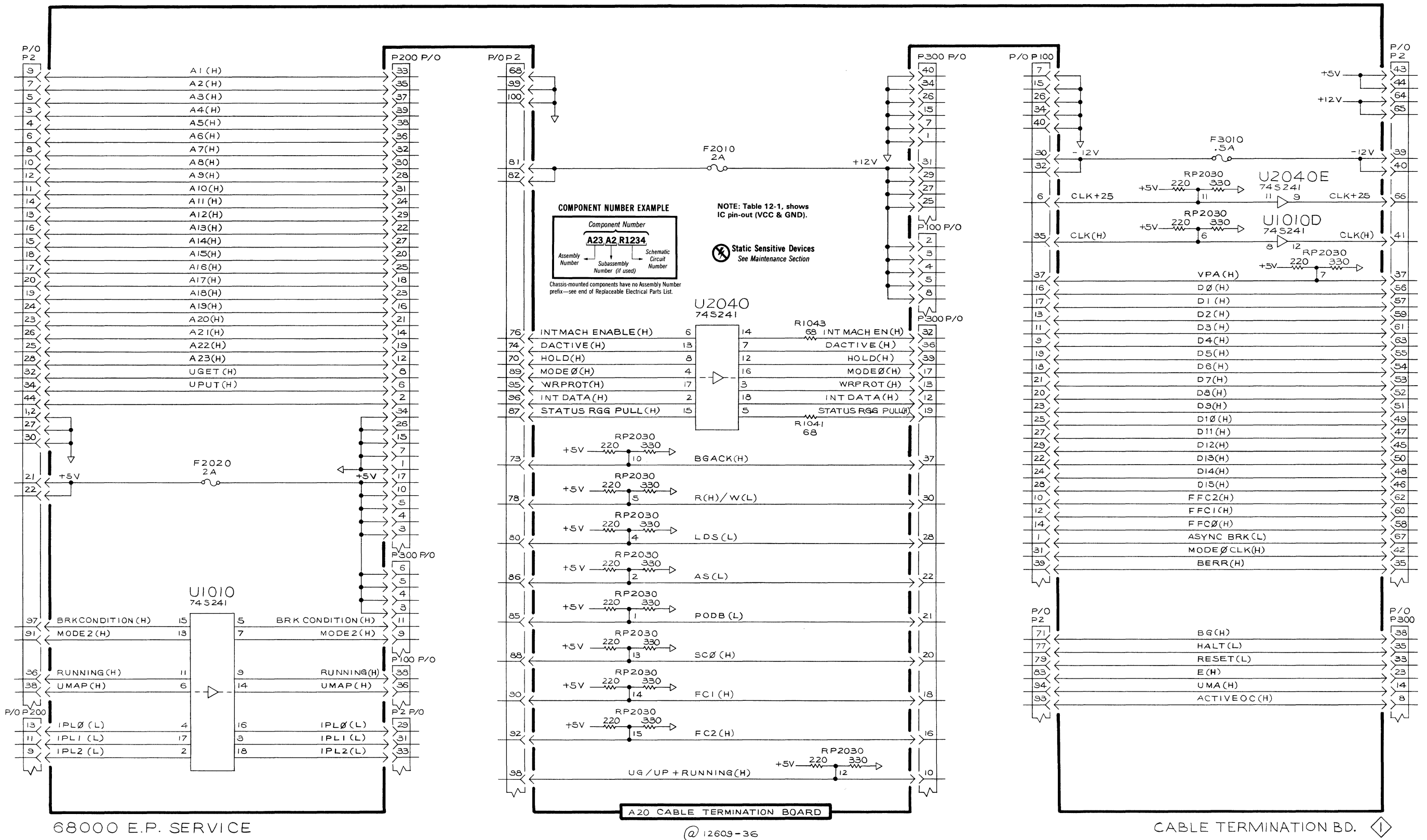
Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

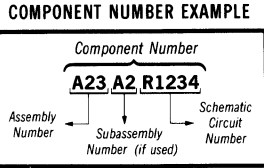
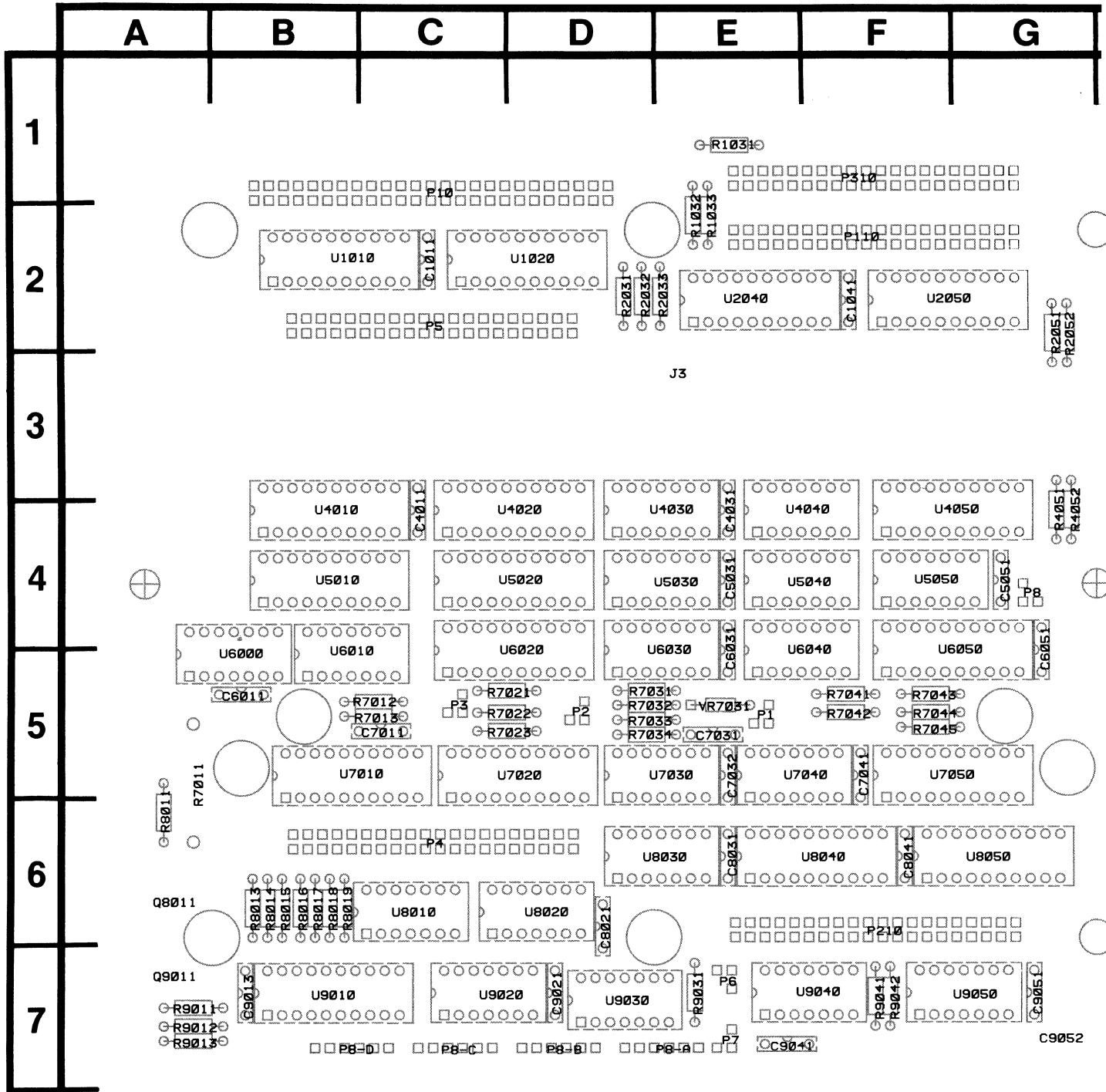
Fig. 12-3. A20 68000 Cable Terminal Board Component Locations.

Static Sensitive Devices
See Maintenance Section

12609-17

CABLE TERMINATION BOARD
COMPONENT LOCATIONS



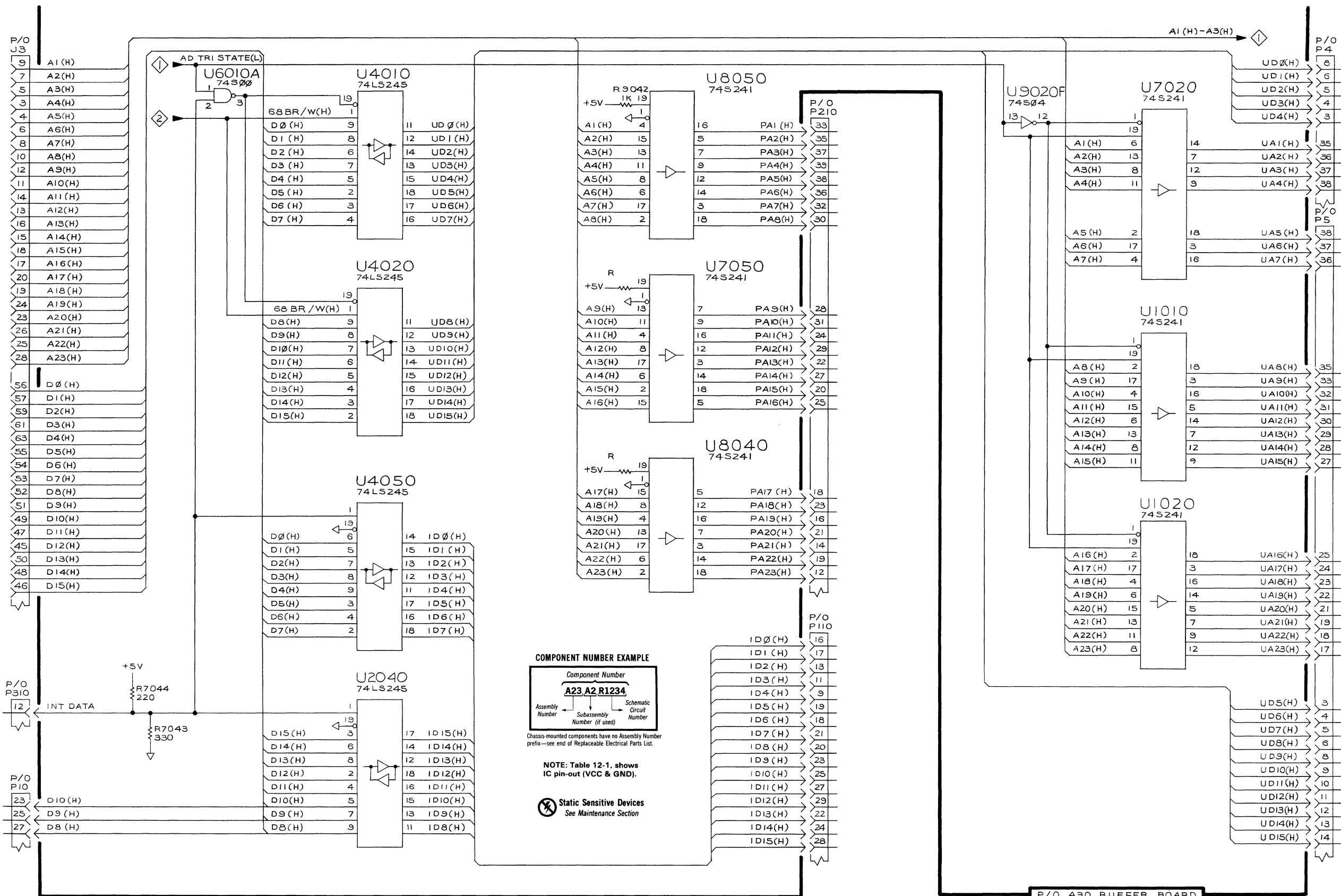


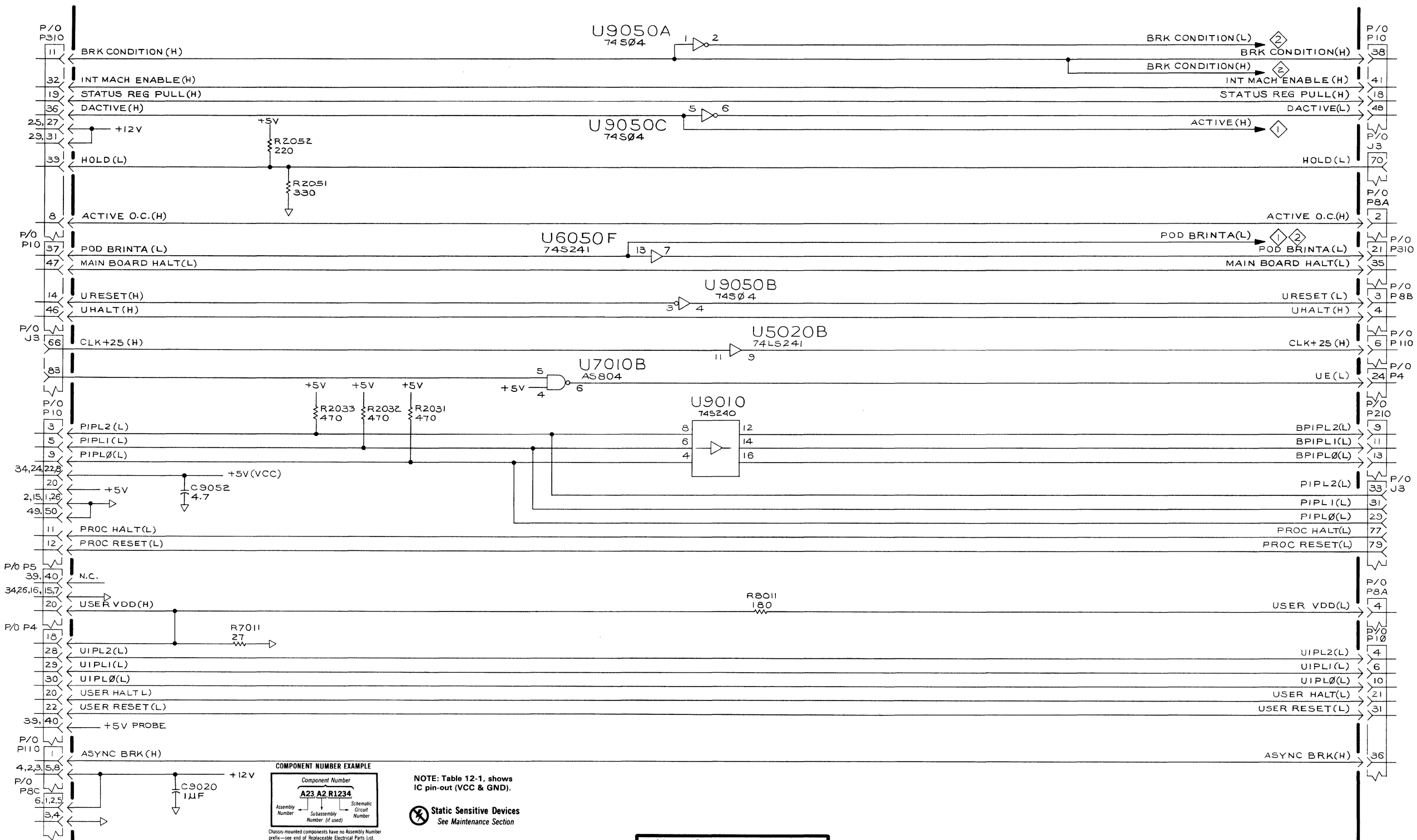
Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

Fig. 12-4. A30 68000 Buffer Board Component Locations.

 Static Sensitive Devices
See Maintenance Section







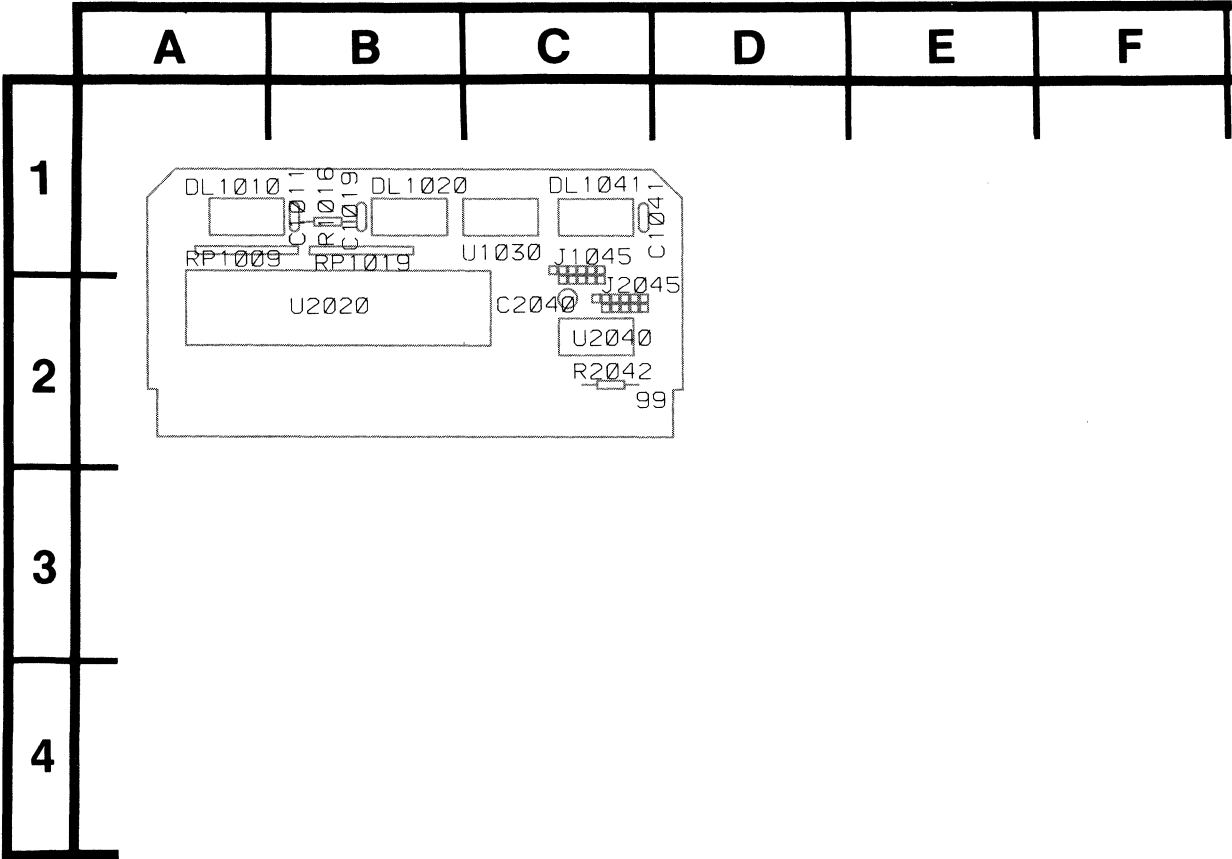
68000 E.P. SERVICE

P/O A30 BUFFER BOARD

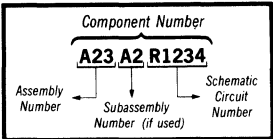
@ 12609-40

BUFFER BD. 4

BUFFER BOARD



COMPONENT NUMBER EXAMPLE

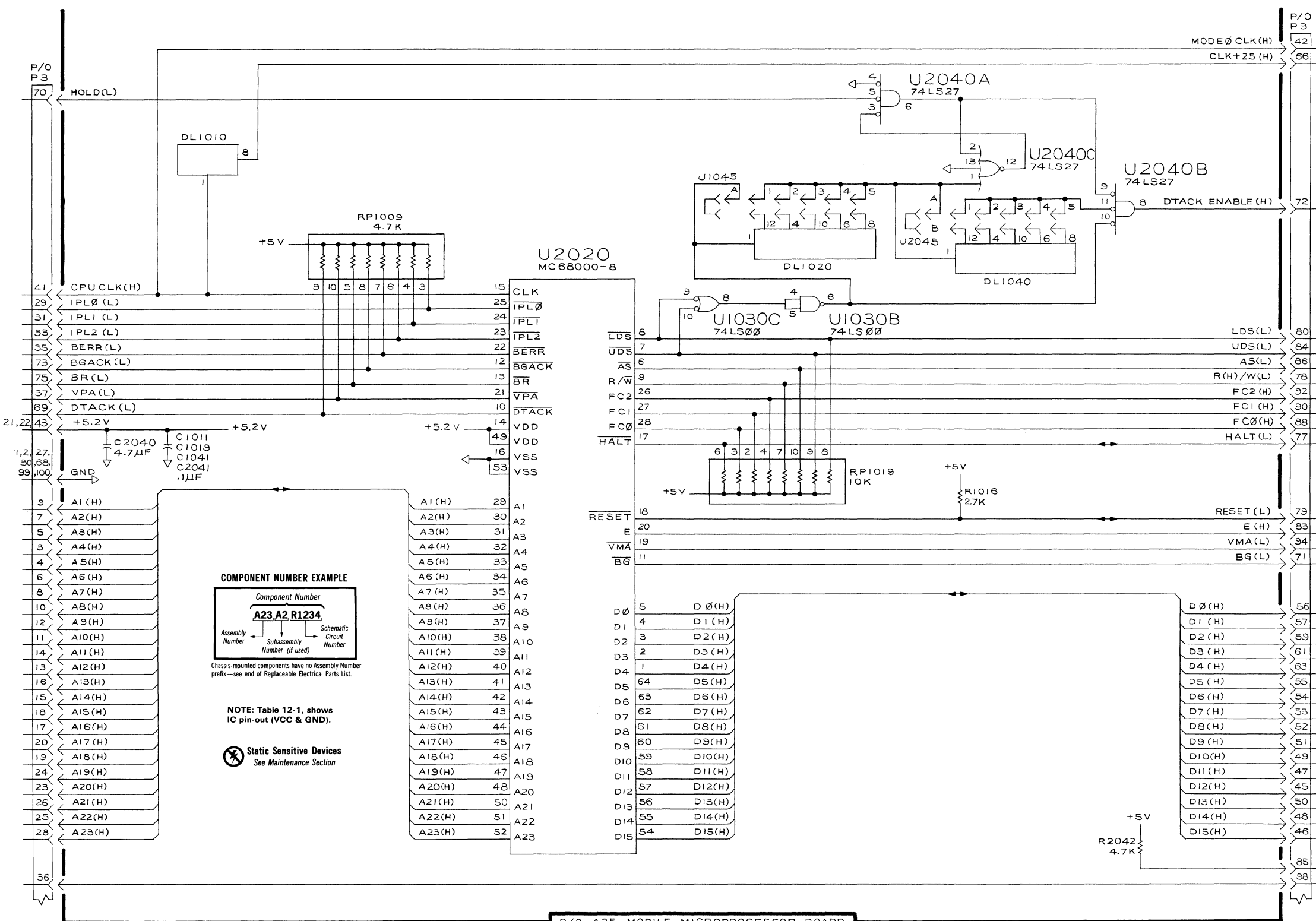


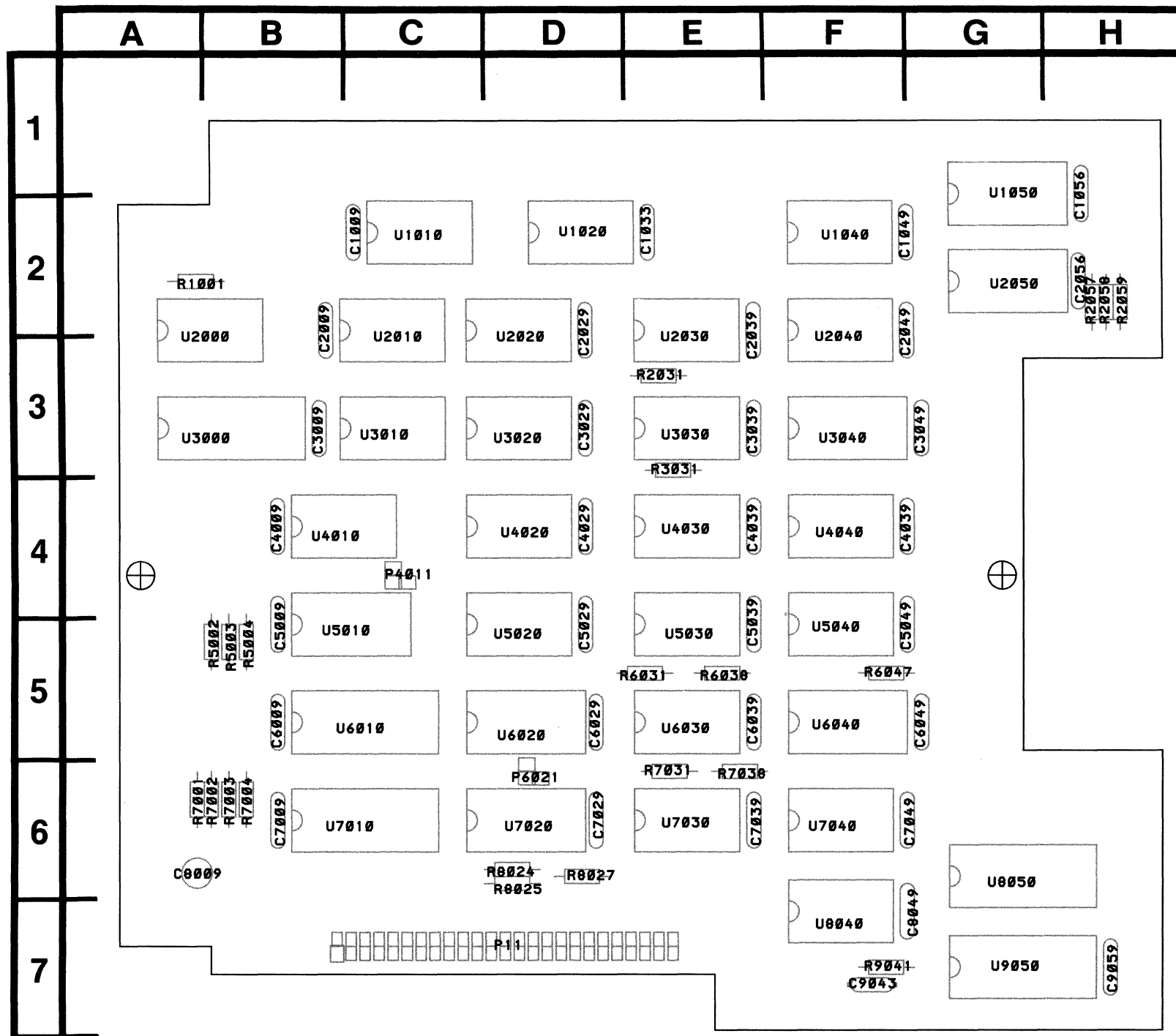
Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

 Static Sensitive Devices
See Maintenance Section

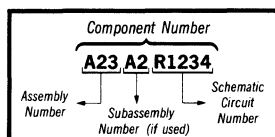
12609-19

Fig. 12-5. A35 68000 Mobile Microprocessor Board Component Locations.





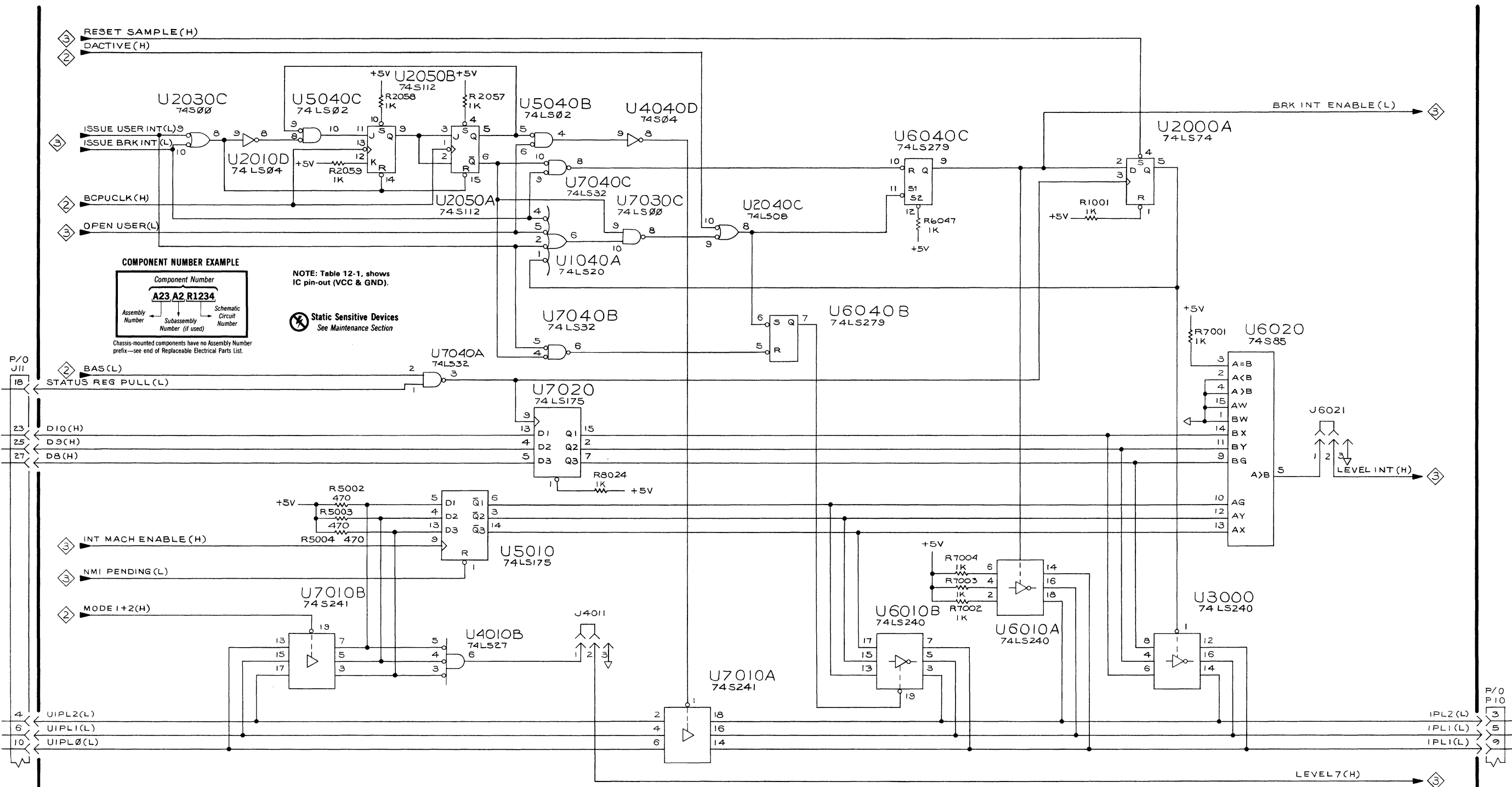
COMPONENT NUMBER EXAMPLE



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

Fig. 12-6. A40 68000 Control Board Component Locations.

Static Sensitive Devices
See Maintenance Section



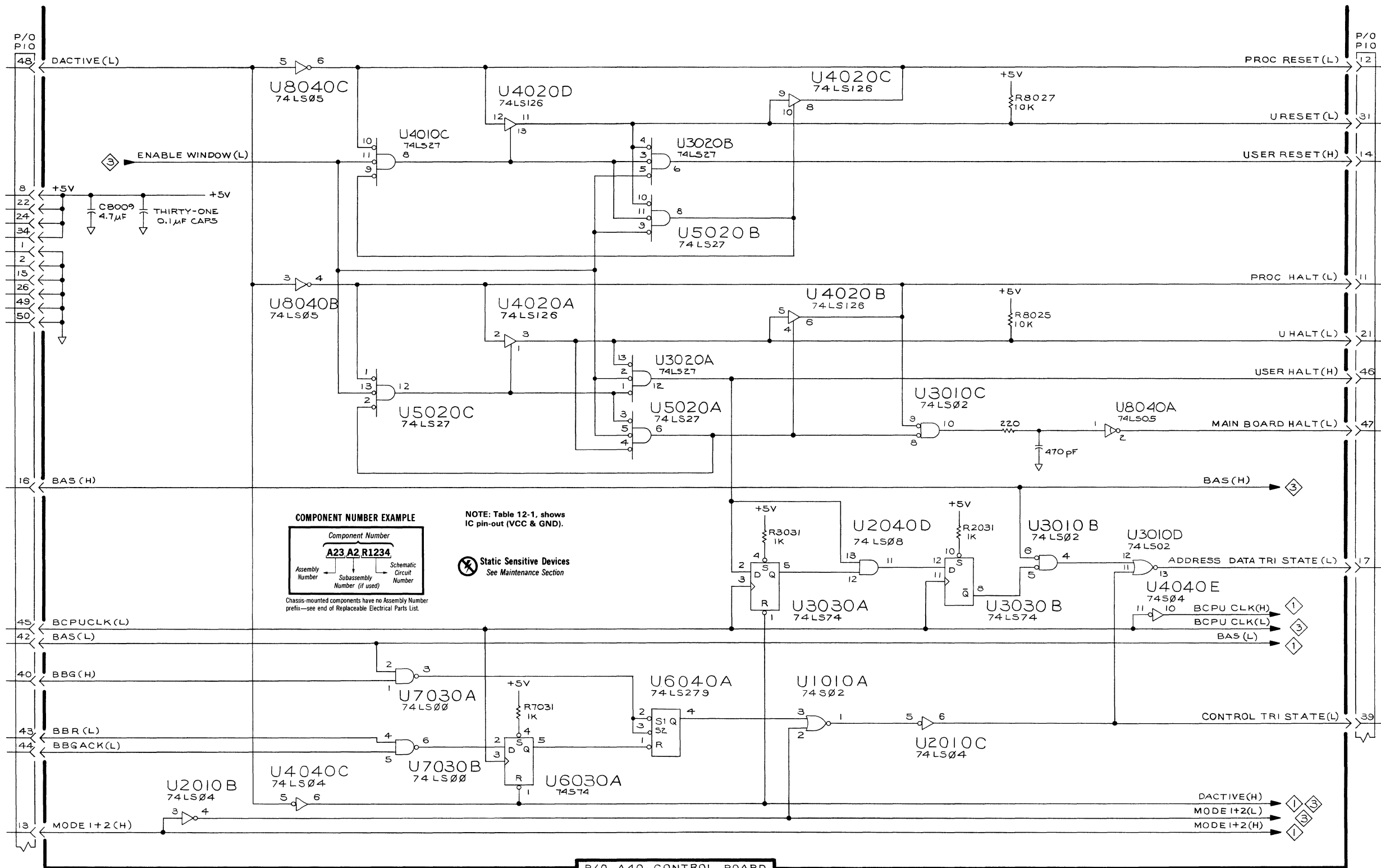
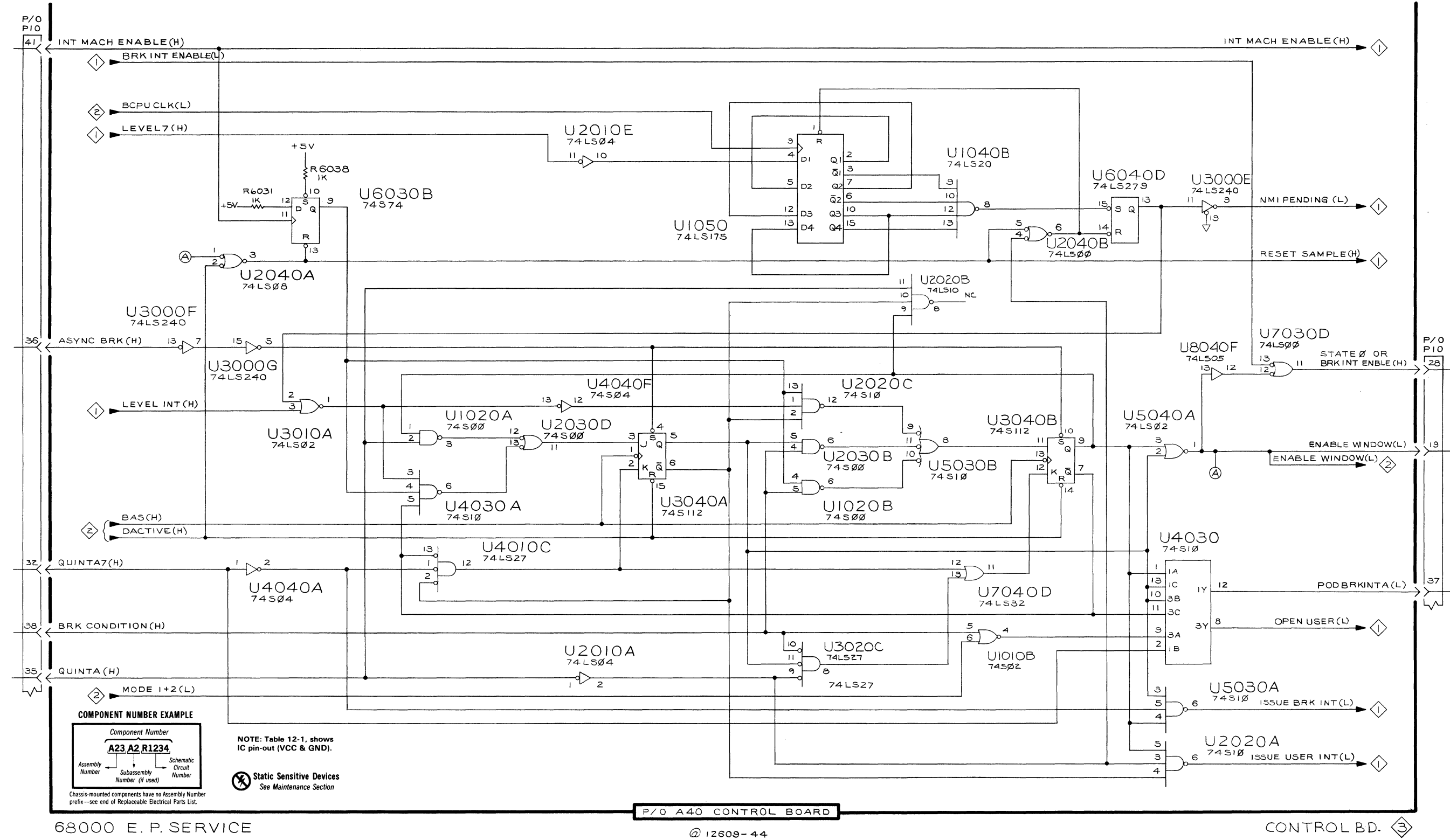
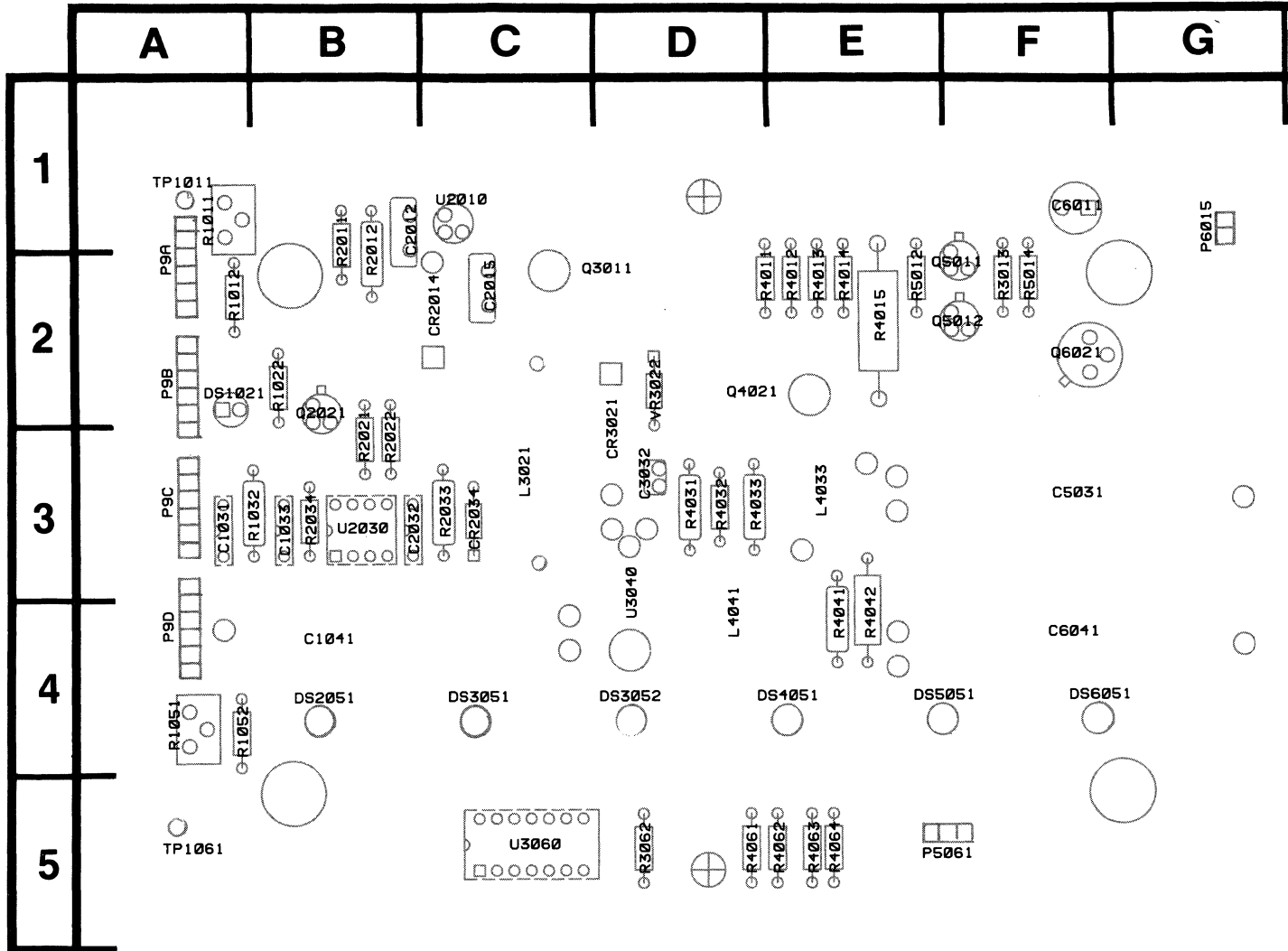


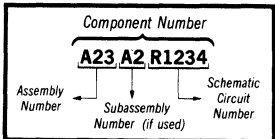
Table 12-4
0.1μF Decoupling Capacitors

C1099	C4039
C1033	C4049
C1049	C5009
C1056	C5029
C2009	C5039
C2029	C5049
C2039	C6009
C2049	C6029
C2056	C6039
C3009	C6049
C3029	C7009
C3039	C7029
C3049	C7039
C4009	C7049
C4029	C8049
	C9059





COMPONENT NUMBER EXAMPLE



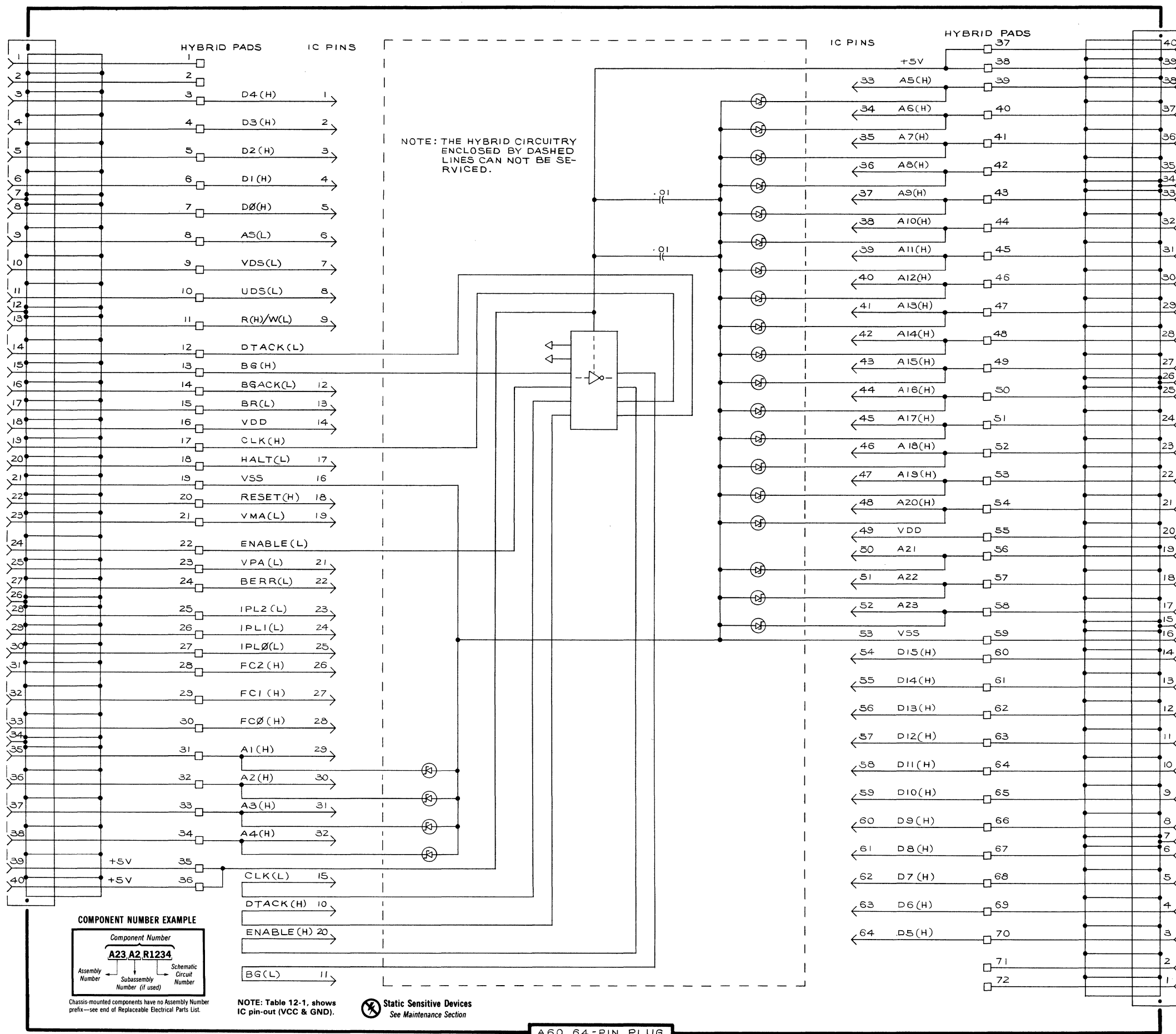
Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

Fig. 12-7. A50 68000 Power Supply Board Component Locations.

Static Sensitive Devices
See Maintenance Section



 **Static Sensitive Devices**
See Maintenance Section



SECTION 13

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number
00X Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 Name & Description

Assembly and/or Component

Attaching parts for Assembly and/or Component

---*---

Detail Part of Assembly and/or Component

Attaching parts for Detail Part

---*---

Parts of Detail Part

Attaching parts for Parts of Detail Part

---*---

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol ---*--- indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH	ELCTRN	ELECTRON	IN	INCH	SE	SINGLE END
#	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ACTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICON	SEMICONDUCTOR
ADPTR	ADAPTER	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
ALIGN	ALIGNMENT	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLDR	SHOULDERED
AL	ALUMINUM	EQPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSEM	ASSEMBLED	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ASSY	ASSEMBLY	FIL	FILLISTER HEAD	MTG	MOUNTING	SLFLKG	SELF-LOCKING
ATTEN	ATTENUATOR	FLEX	FLEXIBLE	NIP	NIPPLE	SLVG	SLEEVING
AWG	AMERICAN WIRE GAGE	FLH	FLAT HEAD	NON WIRE	NOT WIRE WOUND	SPR	SPRING
BD	BOARD	FLTR	FILTER	OBD	ORDER BY DESCRIPTION	SQ	SQUARE
BRKT	BRACKET	FR	FRAME or FRONT	OD	OUTSIDE DIAMETER	SST	STAINLESS STEEL
BR	BRASS	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BRZ	BRONZE	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
BSHG	BUSHING	FXD	FIXED	PL	PLAIN or PLATE	T	TUBE
CAB	CABINET	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CAP	CAPACITOR	HDL	HANDLE	PN	PART NUMBER	THD	THREAD
CER	CERAMIC	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CHAS	CHASSIS	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
CKT	CIRCUIT	HEX SOC	HEXAGONAL SOCKET	RCPT	RECEPTACLE	TPG	TAPPING
COMP	COMPOSITION	HLCPS	HELICAL COMPRESSION	RES	RESISTOR	TRH	TRUSS HEAD
CONN	CONNECTOR	HLXT	HELICAL EXTENSION	RGD	RIGID	V	VOLTAGE
COV	COVER	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CPLG	COUPLING	IC	INTEGRATED CIRCUIT	RTNR	RETAINER	W/	WITH
CRT	CATHODE RAY TUBE	ID	INSIDE DIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DEG	DEGREE	IDNT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
DWR	DRAWER	IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000EO	ZEPHER ELECTRONIC SALES CORP.	647 INDUSTRY DRIVE	SEATTLE, WA 98188
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
06776	ROBINSON NUGENT INC.	800 E. 8TH ST., BOX 470	NEW ALBANY, IN 47150
09922	BURNDY CORPORATION	RICHARDS AVENUE	NORWALK, CT 06852
12327	FREEWAY CORPORATION	9301 ALLEN DRIVE	CLEVELAND, OH 44125
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
31514	STANFORD APPLIED ENGINEERING, INC.		
	ADVANCED PACKAGING DIV.	3080 AIRWAY DRIVE	COSTA MESA, CA 92626
49671	RCA CORPORATION	30 ROCKEFELLER PLAZA	NEW YORK, NY 10020
74921	ITEN FIBRE CO.,	4001 BENEFIT AVE., P O BOX 9	ASHTABULA, OH 44004
75915	LITTELFUSE, INC.	800 E. NORTHWEST HWY	DES PLAINES, IL 60016
78189	ILLINOIS TOOL WORKS, INC.		
	SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
85471	BOYD, A. B., CO.	2527 GRANT AVENUE	SAN LEANDRO, CA 94579
86928	SEASTROM MFG. COMPANY, INC.	701 SONORA AVENUE	GLENDALE, CA 91201

Replaceable Mechanical Parts—68000 E.P. Service

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
8550 OPTION 3U/8300P26											
1-1	334-4291-00		1						MARKER, IDENT:68000 PROTOTYPE CONTROL	80009	334-4291-00
-2	378-0602-01		6						LENS, LIGHT:AMBER	80009	378-0602-01
-3	380-0687-01		1						HSG HALF, PROBE:TOP, DRIVER/RECEIVER, PLASTIC	80009	380-0687-01
-4	129-0935-00		4						SPACER, POST:2.01 L, W/6-32INT THD ONE END	80009	129-0935-00
-5	210-1345-00		4						WASHER, FLAT:0.162 ID X 0.048 THK, STL	86928	5702-64-48-C2
-6	175-2876-00		4						CA ASSY, SP, ELEC:6, 26 AWG, 6.0 L	80009	175-2876-00
-7	-----		1						CKT BOARD ASSY:POWER SUPPLY(SEE A50 REPL) (ATTACHING PARTS)		
-8	211-0601-00		4						SCR, ASSEM WSHR:6-32 X 0.312, DOUBLE SEMS	83385	OBD
-9	210-0823-00		4						WASHER, FLAT:0.14 ID X 0.031 THK, RED FBR	74921	OBD
	-----								- - - * - - -		
-10	131-0993-00		-						CKT BOARD ASSY INCLUDES:		
-11	131-0608-00		1						BUS, CONDUCTOR:2 WIRE BLACK	00779	530153-2
-12	-----		29						TERMINAL, PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
			1						MICROCIRCUIT, DI:(SEE A50U3042 REPL) (ATTACHING PARTS)		
-13	211-0008-00		1						SCREW, MACHINE:4-40 X 0.25 INCH, PNH STL	83385	OBD
-14	210-0586-00		1						NUT, PL, ASSEM WA:4-40 X 0.25, STL CD PL	83385	OBD
-15	210-1178-00		1						WSHR, SHOULDERED:FOR MTG TO-220 TRANSISTOR	49671	DF 137A
									- - - * - - -		
-16	342-0322-00		1						INSULATOR, FILM:TRANSISTOR	80009	342-0322-00
-17	-----		2						TRANSISTOR:(SEE A50Q3010 & Q4020 REPL) (ATTACHING PARTS)		
-18	211-0008-00		2						SCREW, MACHINE:4-40 X 0.25 INCH, PNH STL	83385	OBD
-19	210-0586-00		2						NUT, PL, ASSEM WA:4-40 X 0.25, STL CD PL	83385	OBD
-20	210-1178-00		2						WSHR, SHOULDERED:FOR MTG TO-220 TRANSISTOR	49671	DF 137A
									- - - * - - -		
-21	342-0322-00		2						INSULATOR, FILM:TRANSISTOR	80009	342-0322-00
-22	-----		2						TEST POINT:(SEE A50TP1010 & TP1060 REPL)		
-23	119-0830-03		1						FAN, TUBEAXIAL:12VDC, 2.4W	80009	119-0830-03
									(ATTACHING PARTS)		
-24	211-0019-00		4						SCREW, MACHINE:4-40 X 1.0 INCH, PNH STL	83385	OBD
-25	210-0004-00		4						WASHER, LOCK:#4 INTL, 0.015THK, STL CD PL	78189	OBD
-26	211-0018-00		2						SCREW, MACHINE:4-40 X 0.875 PNH, STL	83385	OBD
-27	129-0517-00		2						POST, ELEC-MECH:0.25 L X 0.25 HEX, AL	80009	129-0517-00
-28	210-0801-00		2						WASHER, FLAT:0.14 ID X 0.025 THK, BRS NI PL	12327	OBD
									- - - * - - -		
-29	252-0571-00		AR						NEOPRENE EXTR:CHAN, 0.234 X 0.156	85471	DIE#1353
-30	348-0171-00		1						GROMMET, PLASTIC:U-SHAPED	80009	348-0171-00
-31	386-4740-01		1						PLATE, FAN MTG:W/BACKET, ALUMINUM	80009	386-4740-01
									(ATTACHING PARTS)		
-32	211-0504-00		4						SCREW, MACHINE:6-32 X 0.25 INCH, PNH STL	83385	OBD
-33	210-0005-00		4						WASHER, LOCK:#6 EXT, 0.02 THK, STL	78189	1106-00
									- - - * - - -		
-34	361-1149-00		1						SPACER, HOUSING:	80009	361-1149-00
-35	337-2953-00		1						SHIELD, ELEC:CKT BOARD	80009	337-2953-00
									(ATTACHING PARTS)		
-36	210-0586-00		6						NUT, PL, ASSEM WA:4-40 X 0.25, STL CD PL	83385	OBD
									- - - * - - -		
-37	361-0762-00		6						SPACER, SLEEVE:0.128 ID X 0.15" L, BRASS	80009	361-0762-00
-38	-----		1						CKT BOARD ASSY:CONTROL(SEE A40 REPL)		
-39	131-0993-00		2						BUS, CONDUCTOR:2 WIRE BLACK	00779	530153-2
-40	131-0608-00		6						TERMINAL, PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
-41	131-2221-00		1						CONN, RCPT, ELEC:CKT BD, 50 CONT, MALE	00779	2-86479-9
-42	175-2051-00		1						CA ASSY, SP, ELEC:50, 28 AWG, 3.0L	80009	175-2051-00
-43	343-1007-00		1						CLAMP, CABLE:4.9 L, ALUMINUM	80009	343-1007-00
									(ATTACHING PARTS)		
-44	211-0522-00		2						SCREW, MACHINE:6-32 X 0.625 FLH, 100 DEG ST	83385	OBD
									- - - * - - -		
	175-4575-00		1						CA ASSY, SP, ELEC:64 PIN, 19.5 L	80009	175-4575-00
	-----		-						(REFER TO MAINTENANCE SECTION)		
-45	175-4576-00		1						CA ASSY, SP, ELEC:48 PIN, 19.5 L	80009	175-4576-00
	-----		-						(REFER TO MAINTENANCE SECTION)		
-46	334-3281-00		1						MARKER, IDENT:MARKED DRIVER/RECEIVER	80009	334-3281-00
-47	334-3280-00		1						MARKER, IDENT:MARKED DRIVER/RECEIVER	80009	334-3280-00

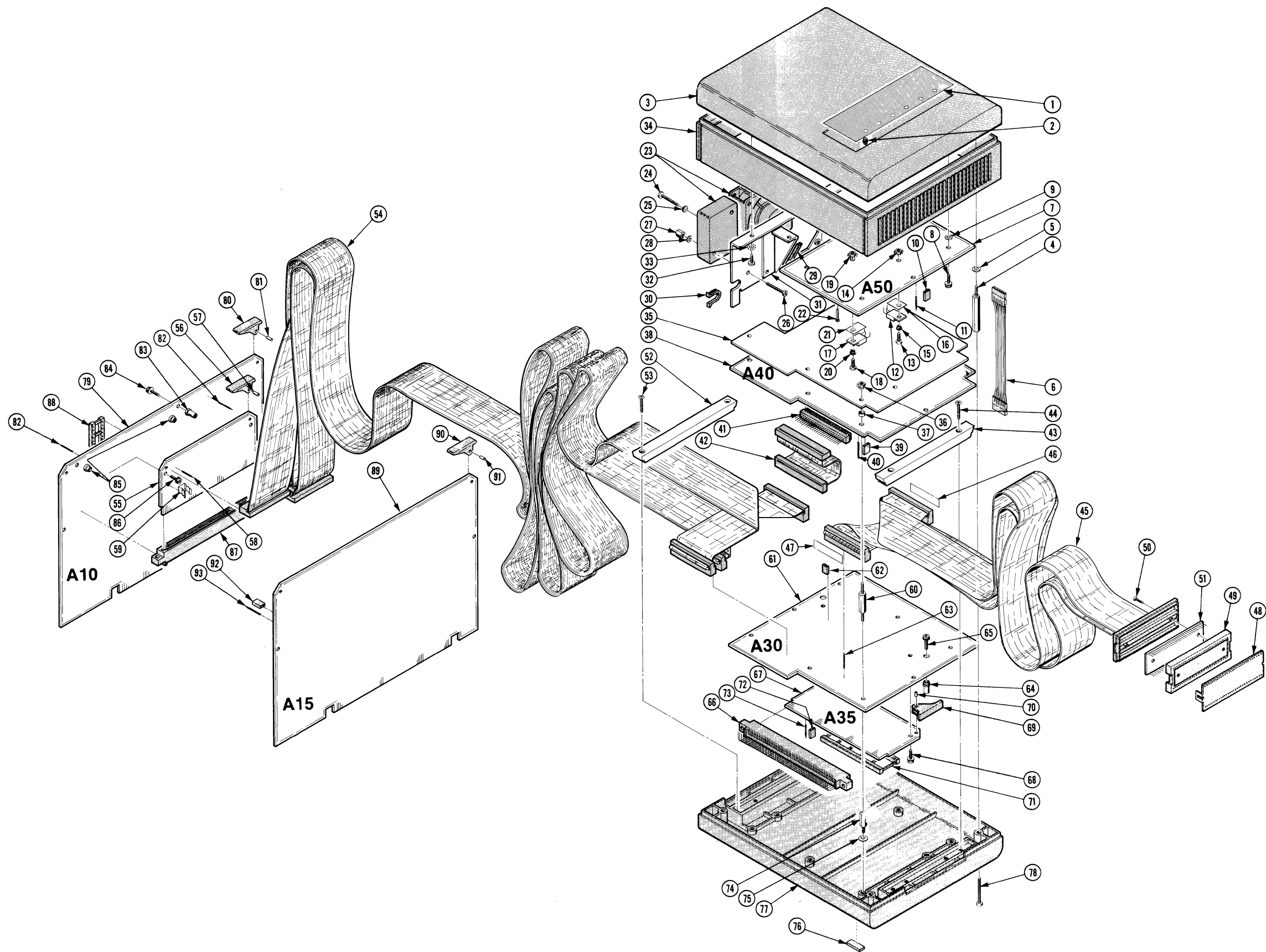
Replaceable Mechanical Parts—68000 E.P. Service

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-48	386-4689-00		1	.	PLATE,PIN PROT:64 PIN,NYLON	80009	386-4689-00
	-----		-	.	(REFER TO MAINTENANCE SECTION)		
-49	204-0913-00		1	.	BODY HALF,PROBE:64 PIN,BOTTOM,NYLON	80009	204-0913-00
	-----		-	.	(REFER TO MAINTENANCE SECTION)		
					(ATTACHING PARTS)		
-50	211-0112-00		2	.	SCREW,MACHINE:2-56 X 0.375,FLH,100 DEG	83385	OBD
	-----		-	-	- * - - -		
-51	-----		1	.	MICROCIRCUIT,DI:(SEE A60U10 REPL)		
	-----		-	.	(REFER TO MAINTENANCE SECTION)		
-52	343-1026-00		1		CLAMP,CABLE:5.33 L,ALUMINUM	80009	343-1026-00
					(ATTACHING PARTS)		
-53	211-0522-00		2		SCREW,MACHINE:6-32 X 0.625 FLH,100 DEG ST	83385	OBD
			-	-	- * - - -		
-54	175-4066-00		3		CA ASSY,SP,ELEC:108,33AWG,72.0 L,RIB	80009	175-4066-00
	334-4329-00		1		MARKER,IDENT:MRK J100	80009	334-4329-00
	334-4330-00		1		MARKER,IDENT:MRK J110	80009	334-4330-00
	334-4331-00		1		MARKER,IDENT:MRK J200	80009	334-4331-00
	334-4332-00		1		MARKER,IDENT:MRK J210	80009	334-4332-00
	334-4333-00		1		MARKER,IDENT:MRK J300	80009	334-4333-00
	334-4334-00		1		MARKER,IDENT:MRK J310	80009	334-4334-00
-55	-----		1		CKT BOARD ASSY:CABLE TERMINATION(SEE A20 REPL)		
-56	105-0792-00		2	.	EJECTOR,CKT BD:PLASTIC	80009	105-0792-00
-57	214-1337-00		2	.	PIN,SPRING:0.10 OD X 0.25 INCH L,STL	80009	214-1337-00
-58	131-0608-00		120	.	TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
-59	344-0326-00		6	.	CLIP,ELECTRICAL:FUSE,BRASS	75915	102071
-60	129-0918-00		6		SPACER,POST:0.812 L,W/6-32 THD INT ONE END	80009	129-0918-00
-61	-----		1		CKT BOARD ASSY:BUFFER(SEE A30 REPL)		
-62	131-0993-00		6	.	BUS,CONDUCTOR:2 WIRE BLACK	00779	530153-2
-63	131-0608-00		292	.	TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	129-0320-00		2	.	POST,ELEC-MECH:0.187 OD X 0.15 INCH LONG	80009	129-0120-00
-64	129-0209-00		2	.	SPACER,POST:0.375 L,W/32 THD THRU	80009	129-0209-00
					(ATTACHING PARTS)		
-65	211-0602-00		2	.	SCR,ASSEM WSHR:6-32 X 0.438 INCH,PNH BRS	80009	211-0602-00
-66	131-2719-00		1	.	CONN,RCPT,ELEC:EDGE CARD,RTANG,2 X 50	31514	MPH7000-100R33
-67	-----		1		CKT BOARD ASSY:MOBILE(SEE A35 REPL)		
					(ATTACHING PARTS)		
-68	211-0116-00		2		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
	-----		-	-	- * - - -		
			-	.	CKT BOARD ASSY INCLUDES:		
-69	105-0792-00		2	.	EJECTOR,CKT BD:PLASTIC	80009	105-0792-00
-70	214-1337-00		1	.	PIN,SPRING:0.10 OD X 0.25 INCH L,STL	80009	214-1337-00
-71	136-0716-00		1		SKT,PL-IN ELEK:MICROCKT,64 CONT	06776	ICN649-S5-G30
-72	131-0993-00		2	.	BUS,CONDUCTOR:2 WIRE BLACK	00779	530153-2
-73	131-0608-00		22	.	TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
-74	129-0936-00		6		SPACER,POST:1.0 L,W/6-32 EXT THD EA END	80009	129-0936-00
-75	210-1345-00		6		WASHER,FLAT:0.162 ID X 0.048 THK,STL	86928	5702-64-48-C2
-76	348-0596-00		4		PAD,CAB.FOOT:0.69 X 0.255 X 0.06,PU	80009	348-0596-00
-77	380-0688-00		1		HSG HALF,PROBE:BOTTOM,DRVR/RECEIVER,PLSTC IC	80009	380-0688-00
					(ATTACHING PARTS)		
-78	211-0529-00		4		SCREW,MACHINE:6-32 X 1.25 INCHES,PNH STL	83385	OBD
			-	-	- * - - -		
8550 OPTION2P/8300E26							
-79	-----		1		CKT BOARD ASSY:EMULATOR I(SEE A10 REPL)		
-80	105-0792-00		2	.	EJECTOR,CKT BD:PLASTIC	80009	105-0792-00
-81	214-1337-00		2	.	PIN,SPRING:0.10 OD X 0.25 INCH L,STL	80009	214-1337-00
-82	131-0608-00		226	.	TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
-83	129-0209-00		2	.	SPACER,POST:0.375 L,W/32 THD THRU	80009	129-0209-00
					(ATTACHING PARTS)		
-84	211-0602-00		2	.	SCR,ASSEM WSHR:6-32 X 0.438 INCH,PNH BRS	80009	211-0602-00
			-	-	- * - - -		
-85	129-0320-00		2	.	POST,ELEC-MECH:0.187 OD X 0.15 INCH LONG	80009	129-0120-00
-86	211-0116-00		2	.	SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
-87	131-2719-00		1	.	CONN,RCPT,ELEC:EDGE CARD,RTANG,2 X 50	31514	MPH7000-100R33
-88	136-0751-00		3	.	SKT,PL-IN ELEK:MICROCKT,24 PIN	09922	DILB24P108

Replaceable Mechanical Parts—68000 E.P. Service

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
1-89	-----	-----	1						CKT BOARD ASSY:EMULATOR II(SEE A15 REPL)		
-90	105-0792-00		2						. EJECTOR,CKT BD:PLASTIC	80009	105-0792-00
-91	214-1337-00		2						. . PIN,SPRING:0.10 OD X 0.25 INCH L,STL	80009	214-1337-00
-92	131-0993-00		1						. BUS,CONDUCTOR:2 WIRE BLACK	00779	530153-2
-93	131-0608-00		123						. TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357

FIGURE 1 EXPLODED



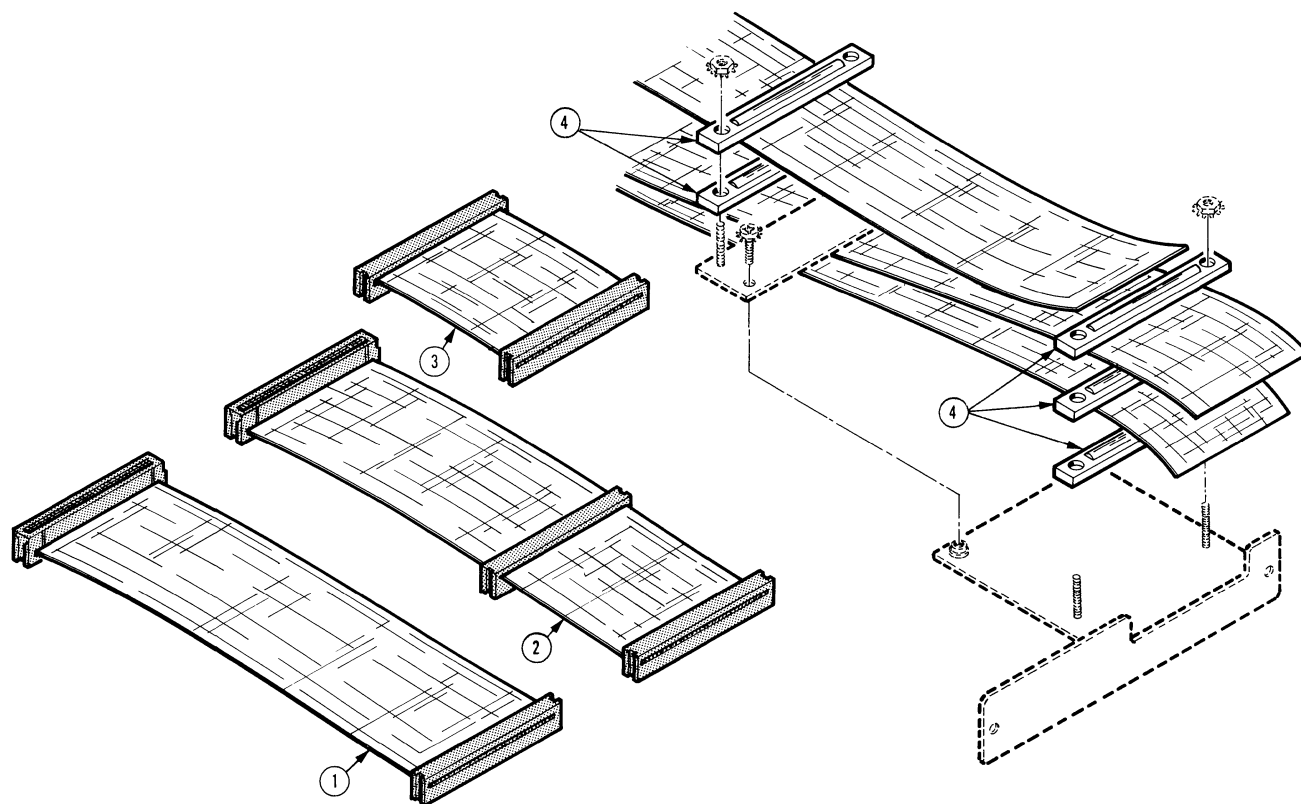


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
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STANDARD ACCESSORIES

2-1	175-3882-00		1						CA ASSY, SP, ELEC: 50, 28 AWG, 8.0L (8550 OPTION 2P/8300E26 ONLY)	000EO	2CA-08218
-2	175-3883-00		1						CA ASSY, SP, ELEC: 50, 28 AWG, 9.0L (8550 OPTION 2P/8300E26 ONLY)	000EO	OBD
-3	175-6671-00		2						CA ASSY, SP, ELEC: 50, 28 AWG, 10.0 L RIBBON (8550 OPTION 2P/8300E26 ONLY)	80009	175-6671-00
	062-5956-00		1						SOFTWARE PKG: DBL SIDED FLOPPY DISC (8550 OPTION 3U/8550P26 ONLY)	80009	062-5956-00
	070-2552-00		1						CARD, INFO: DISC HANDLING (8550 OPTION 3U/8300P26 ONLY)	80009	070-2552-00
	070-3771-00		1						MANUAL, TECH: INSTALLATION (8550 OPTION 3U/8300P26 ONLY)	80009	070-3771-00
	070-3969-00		1						MANUAL, TECH: USERS (8550 OPTION 3U/8300P26 ONLY)	80009	070-3969-00
-4	343-1011-00		5						CLAMP, CABLE: 2.95 L, ALUMINUM	80009	343-1011-00

OPTIONAL ACCESSORIES

061-2609-00		1							MANUAL, TECH: SERVICE, INTERIM	80009	061-2609-00
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